PINCOMM® 750S/730S

MEMORY MODULE

TECHNICAL MANUAL

STANDARD MEMORIES

A DIVISION OF
Trendata CORPORATION

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PINCOMM® 750S/730S

MEMORY MODULE

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DASH No.	MODEL		DESCRIPTION
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CHK	Alfred Egan	12-82	
REL	EW VH	12/7/82	

	SIZE	CODE IDENT	NUMBER	REV
STANDARD MEMORIES A DIVISION OF Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1198 (1/83)	Sheet 1

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SERVICE AND INSTALLATION

INTRODUCTION

This manual provides technical support information and installation procedures for the PINCOMM 750S/730S Add-In Memory to the Digital Equipment Corporation® VAX 11/750 and VAX 11/730 Computers.

Proper safety precautions must be observed in all cases. Before any circuit card or cable is disturbed, the system A-C power and battery backup power should be turned OFF. Do not switch off system power when any tape or disk is in operation.

In all cases, a special effort should be made so that a failure within the PINCOMM 750S/730S does not render the whole system inoperative. The "off-line" switch may be used in most cases. Complete removal of the PINCOMM 750S/730S is an acceptable alternate technique.

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PARTS LIST - P/L 102414
ASSEMBLY - 102414
SCHEMATIC - 102417

SECTION 1.0

GENERAL DESCRIPTION

1.0 DESCRIPTION

The Pincomm 750S/730S memory module, MM-140, is a semiconductor random access memory card designed to be plug-compatible to DEC VAX computers, including VAX 11/750 and VAX 11/730. The MM-140 is a form, fit, and function equivalent to the DEC semiconductor memory card M8728 with 16K RAMs (-442) or M8750 with 64K RAMs (-443).

Memory card capacity of 256K bytes or 1024K bytes is available on the MM-140. Each memory data word stored by the MM-140 is 39 bits wide, consisting of 32 data bits (4 each 8-bit bytes) plus 7 error correction check bits. The check bits provide single bit error correction and double or multiple bit error detection.

The MM-140 is installed directly into the DEC VAX memory area without any changes to DEC hardware or system cabling. Up to eight MM-140 and/or DEC memory cards may be installed in the VAX 11/750, or 5 MM-140 (-443) and/or DEC Memory cards in the VAX 11/730.

CPU	CARD TYPE	SYSTEM CAPACITY
VAX 11/750	DEC M8728 or MM-140 (-442) 16K RAMs	2 megabytes
VAX 11/750	DEC M8750 or MM-140 (-443) 64K RAMs	8 megabytes
VAX 11/730	DEC M8750 or MM-140 (-443) 64K RAMs	5 megabytes

Features of the MM-140 include: Compatible with battery back-up. OFF LINE switch provided, lamp indicators for RUN and POWER-ON, and sockets for RAM IC's are provided, along with spare on board RAMs, to facilitate repair in the field.

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SECTION 2.0

TECHNICAL SPECIFICATIONS

2.0 MM-140 SPECIFICATIONS

2.1 GENERAL

2.1.1 Storage Capacity (-442)

Words: 64K (K=1024)
Bits: 32 data bits plus 7 error correction & check bits
Bytes: 256Kb

Storage Capacity (-443)

Words: 64K (K=1024)
Bits: 32 data plus 7 error.
Bytes: 1024Kb

2.1.2 Word Size

Each 39 bit word contains a 32 bit data word plus the 7 error correction bits.

2.1.3 Memory Speed

Directly compatible and equivalent in performance to the DEC memory.

Mode	All Times Typical Cycle	Access
READ	650 ns	320 ns
WRITE	680 ns	-
WRITE BYTE	1030 ns	330 ns
REFRESH	680 ns	-

2.1.4 Field Expansion

Field expansion is accomplished by adding cards to an existing chassis.

2.1.5 Non-Volatile Data Protection

The standard DEC battery backup system is used by the MM-140 which provides data retention upon power failure.

2.1.6 Power

The MM-140 uses slightly less power than the equivalent DEC memory.

-442 only

Voltage ±5%	Operation	Standby	Battery
+12	1.2A	.25A	.25A
+5 battery	.9A	.8A	.8A
-5	40MA	20MA	20MA
+5	.4A	.35A	-

-443 only

Voltage ±5%	Operation	Standby	Battery
+5	.4	.35	--
+5B	3.0	1.4	1.4

2.1.7 Off Line Switch

Each MM-140 may be electrically isolated (disabled) from the data bus by the Off Line switch, if desired.

2.1.8 Bus Loading

Each MM-140 presents one "DEC Standard" load unit to the internal bus.

Signal	Lines	Load
Bi-directional		
Data		
DB00L to DB31L	32	1
Check Bits		
CB00L to CBTL	7	1
Input Term		
Array Address		
A0H to A5H	6	1
Select Address		
MA14H, MA15H	2	1
Array Address**		
A6H, A7H	2	1

**Not used on -443

2.1.8 Con't.

Signal	Lines	Load
Input Term		
Control Signal		
REF CYCL	1	1*
RAS Tim	1	1*
Add Mem Sel	1	1.2*
CAS Tim	1	1.2*
DR EN L	1	1.2*
CS Tim (A6H) H **	1	1*
WR Byte **	4	1*
WR Tim	1	1.2*
CAS INH **	1	1.2*
Response Terms		
Mem Pres-L	1	1*
FNCP L	3	.2

1 Load Unit = 1.6ma Source Current

2.1.9 Compatibility

The MM-140 is compatible with the DEC type M8728 care (-442) or DEC Type M8750 (-443) when used in VAX 11/750 or VAX 11/730 computers.

2.1.10 Environment

The MM-140 is rated to operate under the following conditions:

Operational Temperature	-	$0^{o}C$ to $55^{o}C$
Standby Temperature	-	$-40^{o}C$ to $80^{o}C$
Humidity (No Condensation)	-	0 to 90%
Thermal Shock	-	$50^{o}C$/Hour Max.
Cooling	-	Standard system air flow or 25 LFM air flow

All conditions are equal to or better than required to operate in the DEC system.

** Not used on -443

2.1.11 Mechanical

The MM-140 is a four layer printed circuit board designed to utilize one standard DEC VAX 11/750 type slot. The dimensions of the cards are 15.688 wide by 8.875 high. Card extractors are designed to be mechanically compatible with the DEC chassis.

2.1.12 The MM-140 is not compatible to MS780 memory system used in the VAX 11/780 computer.

SECTION 3.0

THEORY OF OPERATION

3.0 THEORY OF OPERATION

3.1 THEORY OF OPERATION

The MM-140 memory module is best described as a MOS dynamic RAM array board. A minimum of logic is used to provide bus receivers, array selection, array drive and bus drivers.

3.2 RAMs -442

The MM 140 uses an industry standary 64K x 1 MOS dynamic RAM. The exact functional description of this device is best obtained from any manufacturer data sheets or handbooks on RAMs similar to a 200ns type 4116.

3.2.A RAMs -443

The MM-140 uses an industry standard 64K x 1 MOS dynamic RAM. The exact functional description of this device is best obtained from any manufacturer data sheets or handbooks on RAMs similar to a 200ns type 4164.

3.3 ADDRESS LOGIC, LSB

The low order address provides botht he row address for RAS and the column address for CAS. These addresses are received and gated with a board select signal then buffered before being driven to the RAMs. All multiplexing is accomplished by the system.

3.4 ADDRESS LOGIC, MSB

The two MSB address bits are decoded to select 1 of 4 rows of RAMs for operation.

3.5 BOARD SELECTION

Each memory board is selected by the "ADD Mem SEL-L" signal.

3.6 RAS and CAS

The RAS, Row Address Strobe, is received and gated with row select and by the decode MSB address logic and then driven to one selected group of RAMs.

The CAS, Column Address Strobe, is gated with the RAS logic and driven to all RAMs.

3.7 DREN

The DREN, Data Enable, signal is gated with the select logic to enable the output driver in a read function.

3.8 WRTIM AND WRBYT SIGNALS

The WRTIM, Write Time, is gated with select and is used to enable the drivers for all five bytes. The WRBYT is not used by the MS750.

3.9 REFRESH CYCLES

Since all dynamic RAMs must be periodically refreshed, the Ref Cyc-L signal is provided. It causes a memory cycle to run in which all RAMs receive a RAS but no CAS, which is blocked by the "INH CAS Tim-L" signal, no Write and no DREN. All memory boards in the system refresh simultaneously. The On Line/Off Line switch does not prohibit refresh cycles.

3.10 ON LINE/OFF LINE SWITCH

The On Line/Off Line Switch places all output drivers into a disabled, high Z state. The use of this switch when the machine is running is not recommended.

3.11 CONFIGURATION SIGNAL

These configuration lines provide information on the array board size to the system controller. The MM-140 is preset to set the proper size.

3.12 LED OPERATION

3.12.1 LED 1

The Run LED is on during each memory cycle or refresh cycle. Typically, the LED is dimly on at all times due to refresh and brightly on when many cycles are run by the card.

3.12.2 LED 2

The Power LED is on when the +5 battery voltage is present.

SECTION 4.0

INSTALLATION PROCEDURE
VAX 11/730S+
Scope

This section shows the recommended installation procedure. The following major steps must be done to accomplish a complete installation.

a. Run stand-alone diagnostics
b. Install the memory.
c. Run diagnostics on the new system.

Typical time is between one and two hours

4.0 INSTALLATION PROCEDURE

The intent of this procedure is to provide a comprehensive step-by-step guide for installation of the MM-140 Add-In Memory. Check points are provided to most conveniently isolate problems that might occur. Site record notes should be filled out for each installation to provide data for future reference. (See Appendix A.)

Tools Required: Phillips screw driver, #2.

4.1 PRELIMINARY

Inventory parts provided for the system installation against the shipping list and inspect for shipping damage.

4.1.1 The PINCOMM 730S+ can be directly installed in any VAX 11/730S+

4.2 SITE PRE-TEST

Run the following required diagnostic programs on the VAX 11/750 computer prior to the installation to insure status of the system.

Required:

Memory test ....ENKCC

Optional: All tests on TU-58 #36 730 Micro diagnostics.

4.2.1 Physical Installation

(1) Set disk or tape driver(s) to "UNLOAD" condition.

(2) Turn VAX 11/730 system power key to "OFF" position

(3) Slide the VAX 11/730 out of the rack cabinet. Remove the access panel on the left side of the CPU.

(4) The MM-140 memory modules are directly installable into the DEC VAX 11/730 memory area. See Figure 1 to determine the location of the storage array slots within the VAX 11/730 chassis. The G7273 Grant Card should be removed from the memory slot before installing the MM-140.

The following rules must be used to determine the proper storage array slots for the MM-140.

A. Memories must be installed in sequence starting from slot 6. No blank storage array slots are allowed.

(5) Be sure the On Line/Off Line switch is set to equal On Line.

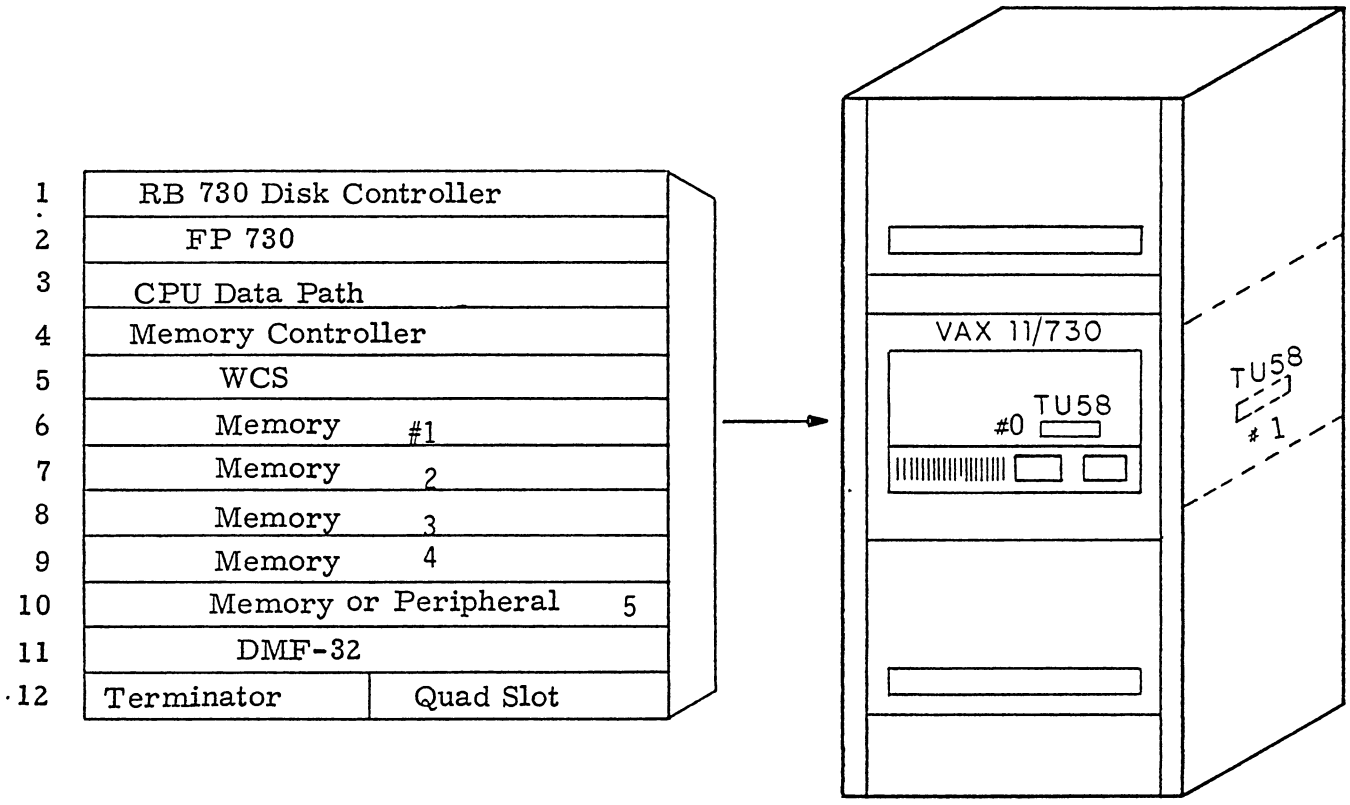
(6) Install the MM-140 into the proper slot of the VAX 11/730 memory chassis.

CAUTION: The board mounting centers on this, and most other DECs, chassis is only 1/2 inch. Gently slide the MM-140 into the card guides and slowly insert the card fully into the slot. The same care in removal of cards is also advised. Most 11/730 memory card cages provide a very tight fit for all hex size boards.

(7) If more than one MM-140 is to be installed, repeat steps 4 to 7 for each memory.

(8) Verify that all of the ON LINE switches are in the ON LINE (up) position.

(9) Power up the CPU.



VAX 11/730

VAX 11/730 - Front View
Figure 1

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 4-3

4.2.2 Repeat the memory diagnostic test program.

If the diagnostic fails or the system fails to "boot" or "load", see the Failure Analysis, Section 5, Entry Point B.

4.2.3 After one complete pass, power OFF and re-install the cover plate and close the main cabinet door.

SECTION 4.0A

INSTALLATION PROCEDURE
VAX 11/750

Scope

This section shows the recommended installation procedure. The following major steps must be done to accomplish a complete installation.

a. Run stand-alone diagnostics.
b. Install the memory.
c. Run diagnostics on the new system.

Typical time is between one and two hours.

4.0 INSTALLATION PROCEDURE

The intent of this procedure is to provide a comprehensive step-by-step guide for installation of the MM-140 Add-In Memory. Check points are provided to most conveniently isolate problems that might occur. Site record notes should be filled out for each installation to provide data for future reference. (See Appendix A).

Tools Required: Phillips screw driver, #2 and a 5/32 hex wrench.

4.1 PRELIMINARY

Inventory parts provided for the system installation against the shipping list and inspect for shipping damage.

4.2 SITE PRE-TEST

Run the following required diagnostic programs on the VAX 11/750 computer prior to the installation to insure status of the system.

Required:

Memory Test .... ECKAM*

Optional:

EVKAB, EVKAC, EVKAD, EVKAE
EKBDBØ ECKAL
ECKAX

*Diagnostic name denotes typical revision level. Any later version is also acceptable.

4.2.1 Physical Installation

(1) Set disk or tape driver(s) to "UNLOAD" condition.

(2) Turn VAX 11/750 system power key to "OFF" position

(3) Use the hex wrench to OPEN door on the main cabinet of the VAX 11/750 CPU. Remove the cover plate by loosening the four corner screws and then lifting out.

(4) The MM-140 memory modules are directly installable into the DEC VAX 11/750 memory area. See Figure 2 and 3 to determine the location of the storage array slots within the VAX 11/750 chassis.

The following rules must be used to determine the proper storage array slots for the MM-140.

A. Memories must be installed in sequence starting from array slot 0. No blank storage array slots are allowed.

B. When 64 K RAMs (-443) and 16 K RAMs (-442) are mixed in the same system, the 64 K RAM boards must go into the lowest numbered slots.

(5) Be sure the On Line/Off Line switch is set to equal On Line.

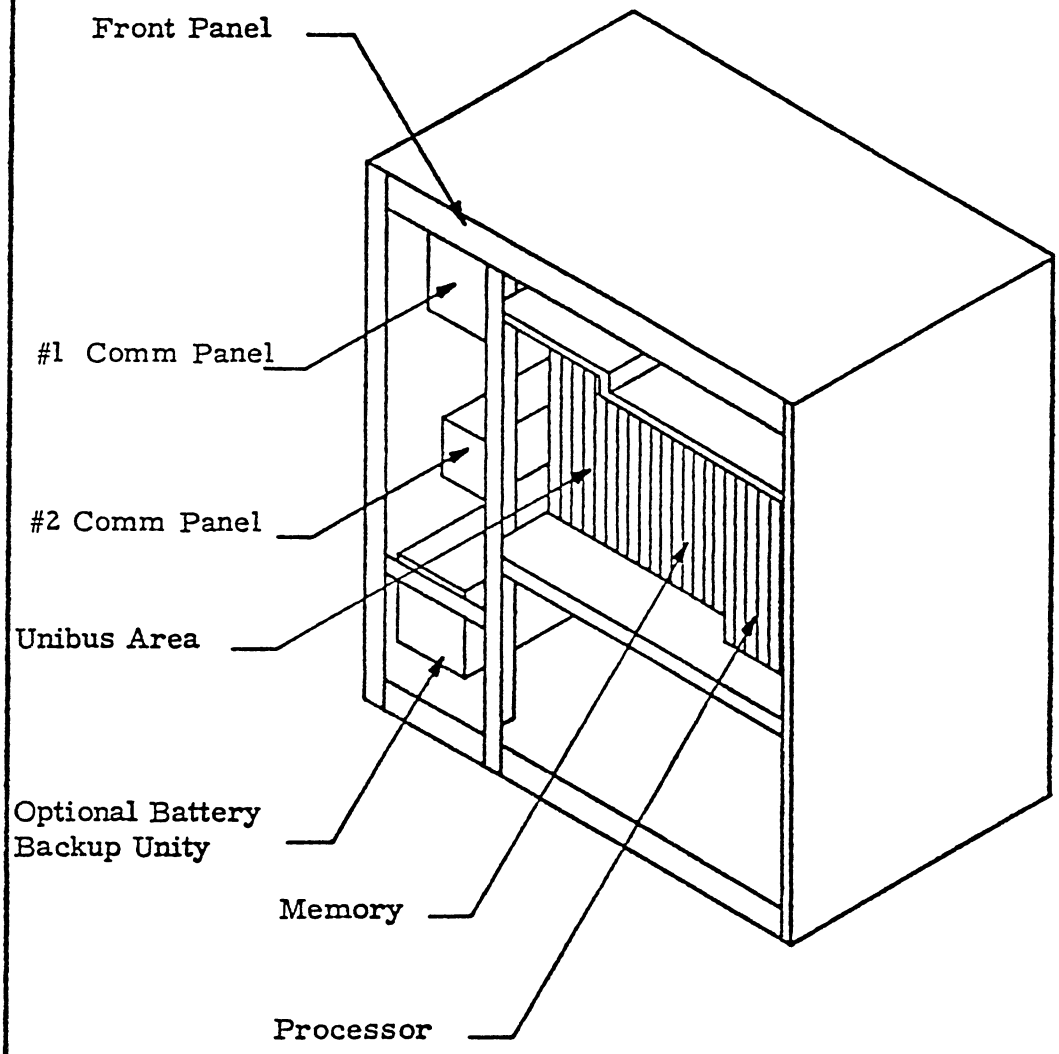
(6) Install the MM-140 into the proper slot of the VAX 11/750 memory chassis.

CAUTION: The board mounting centers on this, and most other DECs, chassis is only 1/2 inch. Gently slide the MM-140 into the card guides and slowly insert the card fully into the slot. The same care in removal of cards is also advised. Most 11/750 memory card cages provide a very tight fit for all hex size boards.

(7) If more than one MM-140 is to be installed, repeat steps 4 to 7 for each memory.

(8) Verify that all of the ON LINE switches are in the ON LINE (up) position.

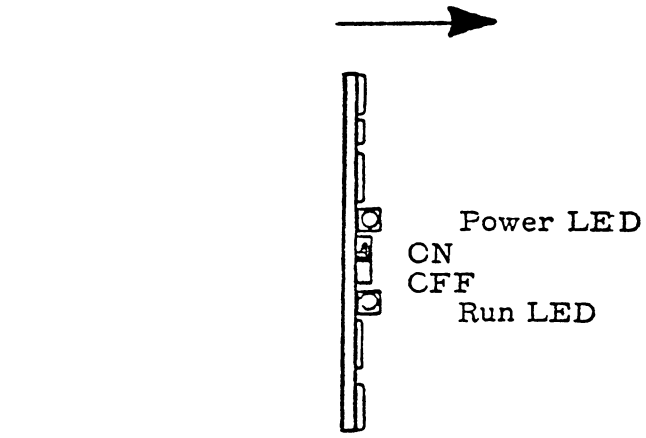
(9) Power up the CPU.

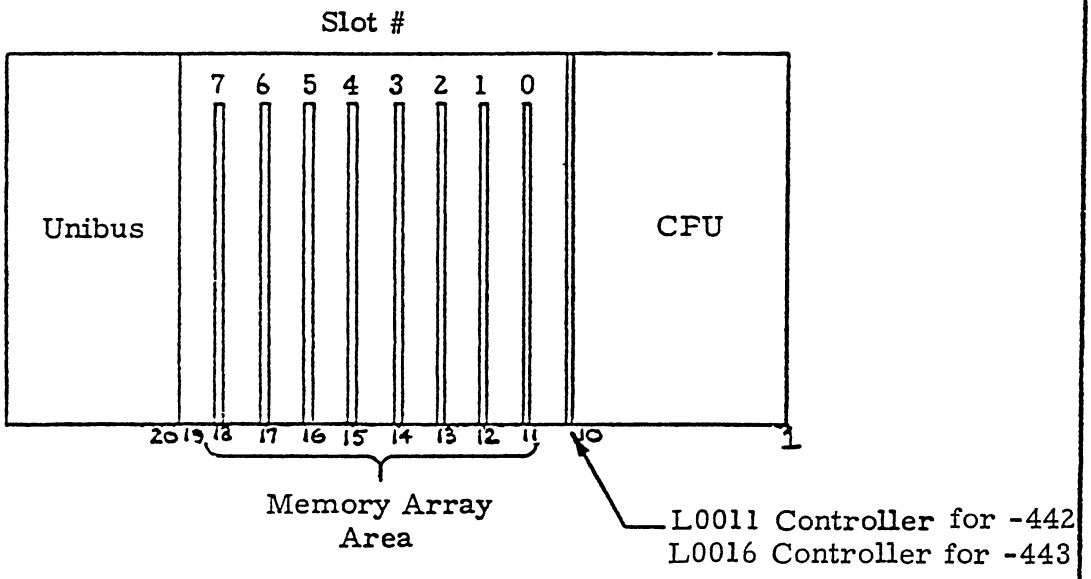


VAX 11/750
FRONT VIEW

Figure 2

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 4A-3




Slot #
7 6 5 4 3 2 1 0
Unibus
CPU
20 19 18 17 16 15 14 13 12 11 10 1
Memory Array Area
L0011 Controller for -442
L0016 Controller for -443

Caution: Do not install DEC M8750 or Trendata MM 140-443 if a Type L0011 Controller is present.

MEMORY ARRAY SLOTS

Figure 3

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 4A-4

4.2.2 Repeat the memory diagnostic program ECKAM or equivalent. If the diagnostic fails or the system fails to "boot" or "load", see the Failure Analysis, Section 5, Entry Point B.

4.2.3. After one complete pass, power OFF and re-install the cover plate and close the main cabinet door.

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SECTION 5.0

FAILURE ISOLATION

5.0 ISOLATION OF FAILURE

This section contains a list of typical failures seen in the installation of the MM-140. In all cases of trouble, the list should be checked from the designated entry point, starting at a major sub-section and proceeding one step at a time. If any action is requested, it should be done and the system rechecked before the next step is taken.

5.1 ENTRY POINT A

These steps should be used only if specifically directed to Entry Point A. Typical failures covered are in operation of the diagnostics.

5.1.1 Program will not load:

a. Media not loaded or mounted correctly.

b. Drive not "On-Line", "Ready", or at Load Point.

c. Unit requested not unit 0. The diagnostics typically run only from unit 0.

d. Bad boot address; try again.

e. Bad unit address; try again.

f. Improper console operation; see Processor Handbook.

g. See Device Codes Section.

h. Ask someone else to review your set-up.

i. A red light on the memory control card indicates misconfiguration, Sec. 5.2.1C.

5.1.2 Program loads but does not respond properly.

a. Wrong volume of media loaded; check the directory.

b. Typing error; try typing again.

c. Name not correct. Get directory for this volume.

d. See Device Code Section.

5.2 ENTRY POINT B:

Typical failure: Problems with installation at Step 4.4.2 only. System will not run at all. Use the diagnostic trace feature to check if all memory is failing or if only a partial failure exists. (See Section 7.3).

5.2.1 All Memory is Failing:

a. Examine the memory status registers, CSR0, CSR1 and CSR2 for valid data.

b. Improper seating of a card.

c. Observe the memory control card's configurate LED if this red LED is on the system and is not configured correctly. Remove all newly installed memories and then retest by installing one board at a time.

d. Reset the system and try again.

e. Re-try the diagnostics.

(1) If successful, the failure could be:

- Improper operating technique.

- Poor operation of the disk on tape drive.

(2) If unsuccessful:

- Go back to Section 4.2.

5.2.2 Partial Failure:

Partial failure is valid only if the diagnostics will load and run but shows errors.

a. Bad MM-140 board or bad chip on the MM-140. A typical procedure at this point is to set all but the first memory to OFF LINE status or physically remove all but the first memory and then retry the diagnostics. Be sure to isolate the errors to the proper board.

If more than one MM-140 is present, rotate each additional MM-140 into the system in order to isolate the bad board.

The tables in Section 8.0 should allow you to find the error to the single chip level.

(1) Recheck that all boards touched are in proper positions. See the chart on cover.

5.3 ENTRY POINT C:

Typical Failure: Initial installation of MM-140 in On-Line mode.

5.3.1 System will not operate at all:

a. Recheck operation procedures.

b. Set MM-140 On-Line/Off-Line switch to OFF-LINE and re-run diagnostics. If unsuccessful, go to Entry Point B.

c. System not configured correctly, recheck Section 4.2.1

d. Remove all newly installed memories and recheck them for damage due to installation.

5.3.2 System loads but diagnostic fails without a full printout. See Section 7 for a sample printout.

a. Recheck operational procedure. See Entry Point A.

b. Set all MM-140's to OFF-LINE and try again. If the problem is solved, go to Section 7.3

c. Try disabling the cache, if present.

d. See 5.3.3.

e. The problem may be outside the memory area and due to the increased size of the system, the following areas should be re-checked with the appropriate diagnostics:

VAX 11/750	VAX 11/730
Cache	Data Path
CMI Logic	Memory Controller
CPU	WCS

f. The diagnostics can be operated in non-standard mode. If possible, obtain the Digital Equipment manual.

g. Try re-configuring the system to double check the problem symptoms. The following suggestions may be helpful:

Interchange a DEC memory with the MM-140.

Remove the last DEC memory and replace it with the MM-140. Try removing two DEC memories, etc.

5.3.3 System Loads and Diagnostic Fails with Full Printout

a. Check that the on line/off line switch is set to ON LINE on each MM-140 card.

b. Use the Diagnostic Section to isolate the failure to the simplest level, if the failure is within the range of the MM-140.

(1) Remove failing board from the system. Reconfigure or if possible, repair it and replace into the system and rerun the diagnostics.

(2) Spare RAM chips are provided in case of a RAM failure. Chips U192 and U193 are fully tested spare replacement chips.

(3) Only normal chip handling precautions are required to replace a bad chip. See Section 8.4

c. If the failure is not within the address range of the MM-140:

(1) Recheck that all boards touched during installation are properly positioned.

(2) Switch all MM-140's OFF LINE and try the diagnostic again.

(a) Recheck system configuration and go back to pre-site testing at Section 4.2.

(b) If multiple MM-140's are present, configure the system to allow testing one unit at a time and attempt to find the bad card.

5.3.4 Memory diagnostic runs correctly without errors but the total memory size i.e. 'Highest Long Word Address' is wrong.

a. Recheck that each MM-140 is set to "ON LINE".

5.3.5 Memory diagnostic runs correctly but other program fails.

a. Verify failure both with and without MM-140's present.

b. Check for 'known' bugs in software operation.

(1) Some programs may be size sensitive.

c. Random or intermittent failures:

(1) The VAX memory system will correct any single bit errors automatically.

(2) The use of the system level error logging programs may be helpful in solving this type of problem.

(3) Run the normal memory diagnostic for an extended period of time.

(a) Use the diagnostic to find single bit errors.

5.4 ENTRY POINT D

These steps should be taken only when a failure occurs sometime after installation.

5.5.1 All failures should be confirmed by using the recommended diagnostics and then using Entry Point D.

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SECTION 6.0

REPAIR AND WARRANTY

6.0 REPAIR AND WARRANTY

6.1 REPAIR

The MM-140 is designed to allow the user to replace any RAM chip, if desired. This should be the most common field failure. (Section 8.4 explains this procedure). Since the MM-140 is a four layer printed circuit board, the customer is liable for any charge for repair to correct damage resulting from customer repair attempts.

6.2 WARRANTY

Trendata products are covered by a four year limited warranty. Therefore, the return of the failing unit to the factory is the best method of repair. If return should be necessary, please observe the following rules:

1. Include a short note stating the mode of failure.
2. Include the name, address and phone or telex number of the owner and the name of someone who can be contacted for further information, if necessary.
3. Properly package the failing unit, preferably in its original box for shipment. Air freight is usually the fastest means of shipment.
4. Return to: Trendata
   3400 W. Segerstrom
   Santa Ana, CA 92704
   USA

   Attention: Repair Department.

6.3 REPAIR OUTSIDE OF WARRANTY

If a unit is not within its warranty period, repair can be done as within the warranty period except that a charge will be made for the work required. A minimum charge is made on any unit returned, regardless of the work performed.

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SECTION 7.0

DIAGNOSTIC PROGRAM PROCEDURE

VAX 11/730

7.0 DIAGNOSTIC PROGRAM OPERATION PROCEDURE

7.1 DIAGNOSTIC MONITOR OPERATION

The following section describes the use of the Digital Equipment type diagnostic monitor.

The program is available as a TU-58 Cassette.

TU 58 #36 VAX 11/730 Micro Diagnostic

1. Verify the diagnostic program is available.

2. Mount the media in TU 58 Drive 1.

3. "Boot" the program, record the boot procedure and other relevant information for future reference.

   A) Typical procedure for a VAX 11/730 bootstrap:

   Set Auto Start switch to OFF

   Turn the Restart Keylock to Local.

4. The TU-58 will Auto Boot from Unit 1.
   The TU-58 is very slow and the booting sequence produces several intentional errors before the MIC> is printed.

4. The typical response to MIC> is DI (for DIagnose)
   Alternately, the following sequence may be used.

   MIC> ST ENKCC

   Runs only the Memory Test.

   Also,

   MIC> set trace
   MIC> ST Test name

   will produce a more complete printout.

SAMPLE DIAGNOSTIC

```
CONSOLE
?03 READ ERROR DD1
?01 FILE NOT FOUND  DDO:CONSOL.EXE

CONTINUING

?03  READ ERROR DD11

 CONTINUING

VER 01.00
MIC>DI
ENKBA-V01.00
HIGHEST WCS ADDRESS AVAILABLE: 43FF

ENKBB-V01.00

ENKBC-V01.00

ENKBD-V01.00

ENKBE-V01.00
HIGHEST WCS ADDRESS AVAILABLE:  43FF

ENKCA-V01.00

ENKCB-V01.00

ENKCC-V01.00
MEMORY SIZE IN 256K BLOCKS (IN HEX)  =08
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #00 = 000000  ARRAY #01
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #01 = 000000  ARRAY #01
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #02 = 000000  ARRAY #01
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #03 = 000000  ARRAY #01
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #00 = 000000  ARRAY #02
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #01 = 000000  ARRAY #02
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #02 = 000000  ARRAY #02
SINGLE BIT ERRORS DETECTED ON 256 KB BLOCK #03 = 000000  ARRAY #02
UBE NOT PRESENT

ENKCD-V01.00
ENKCE-V01.00
FPA NOT PRESENT

ENKCF-V01.10
IDC NOT PRESENT
R80 PRESENT DRIVE 01
EOP 0001

MIC>
```

TYPICAL ERROR
VAX 11/730

```
MIC> ST ENKCC

        ENKCC -V01.00
        SECT     TST     ERR     EXP     REC     OTHER     MASK          MODULE
        ENKC      08      01       C       A       N/A    FFFFFF00       M8391
```

Single Bit Error typically is reported in ENKCC
Test 21

Single Bit Error Detect on 256Kb Block #00 = Syndrome Array #00

1. The ARRAY number can be compared to Figure 1.

2. The Syndrome Code should be converted to Hex and Compared to Table B.

3. The 256Kb Blocks are:

   #
   00 = Row A
   01 = Row B
   02 = Row C
   03 = Row D

4. Then use the Ram Location chart to find the bad RAM.
   See Section 8.0 Table A

SECTION 7.0A

DIAGNOSTIC PROGRAM PROCEDURE

VAX 11/750

7.0 DIAGNOSTIC PROGRAM OPERATION PROCEDURE

7.1 DIAGNOSTIC MONITOR OPERATION

The following section describes the use of the Digital Equipment type diagnostic monitor.

The program is available on Disk Pack, Mag Tape, or DEC Tape. The procedure described, herein, is valid for all types of media.

1. Verify the diagnostic program is available.

2. Mount the media and put the device On-Line and ready.

3. "Boot" the program, record the boot procedure and other relevant information for future reference.

   A) Typical procedure for a VAX 11/750 bootstrap:

   Set "Boot Device" switch to proper code

   Set "Power on Action" switch to "Boot"

   Power on via the system power key and set to local position.

4. The diagnostic monitor is available either directly from a diagnostic media or as file on the VMS System Device.

   To boot the diagnostic monitor from a VMS System Device. type:

   ```
   >>> I
   >>> B/10 Device Code Channel Unit
            (DMAO for an RK07 unit on Channel A)
   ```

   To boot the diagnostic monitor from the DECTAPE TU-58.

   ```
   >>> I
   >>> B  Device Code Channel Unit
          (DDAO for a TU-58)
   ```

5. If the diagnostic monitor, ECSSA.EXE, is not available on the system disk or diagnostic disk with the B/10 .... Boot Sequence, the TU-58 may also be used to run diagnostics.

   Locate the TU-58 Diagnostic Tape #6 or #17

   #6. "RH750/DW750" BE-S199E-YE (Typically)

   #17 VAX 11750 RD DIAG. BE-S402B-YE (Typically)

   Install it into the front panel TU-58

   Set the "Power On Action" switch to Boot and the "Boot Device" switch to the TU-58 ROM, typically Device A, for auto booting.

   If the system is on, push the white "Reset" button or if the system is off, turn the Power Key to "Local". The system console should respond with the diagnostic supervisor prompt DS>

   OR

   Type:

CTRL	P	Console Access Code
	H <Ret>	Halt
	I <Ret>	Init
	B/10 DDAO <Ret>	Boot diagnostic from TU-58 on Channel A Unit O

   Wait while the diagnostic supervisor is loaded.
   It will prompt with DS>
   Locate the TU-58 Diagnostic #5
   "CACHE TY/MEM/EXR"
   BE-S198D-YE (Typically)

   Replace Tape #6 with Tape #5.
   Go to Section 7.3

6. TU-58 activity is indicated by the Red Light to the left of Drive.
7. The TU-58 is very slow. A typical load can take 5 minutes.

7.2 DEVICE CODES, CHANNEL, UNITS AND ERRORS

1. The following are valid device codes:

   DL for RL 02
   DM for RK 06/07
   DB for RP 04/05/06
   DR for RM 03/05/80
   DD for TU 58

2. The channel codes are:

   A for the first adapter
   B for the second adapter

   If in the DS Mode, type:

   DS > @ CONFIG

   to examine the configuration file.

3. Unit codes are determined by configuration. 0, 1, 2 or 3 is typical.

4. Console Error Codes

   08 No Boot Block on Media
   11 Illegal Access
   20 Access Violate
   30 Checksum Error
   33 Unrecognizable Boot Device
   34 Controller not in A, B, C or D ROM
   16 Unable to Boot

5. Useful Control Characters

   CTRL C Ignore all characters from last carriage return
   CTRL D Go to Remote Diagnostic Mode

6. Boot Flags

   1 Regular Boot
   2 Go to VMS Debugger
   4 Initial Breakpoint
   10 Diagnostic Boot
   20 Boot Breakpoint
   40 Image Header
   80 Inhibit Memory Test
   100 Boot File by Name
   200 Halt Before Transfer

7.3 DIAGNOSTIC OPERATION ECKAM

When using the Diagnostic Supervisor ZZ-ECSSA, the memory diagnostic can be run by entering the following code:

```
DS> ATT MS750 CMI MS0
DS> SEL MS0
DS> SET TRACE
DS> RUN ECKAM
```

The operation of the diagnostic is automatic from this point. See the 'Typical' example and 'Error' example.

7.3.1 Diagnostic Problem (BUG) Report September 1981 ECKAM Rev. 1.2 Only.

A. Diagnostic does not function correctly when eight 256kb Modules installed.

Symptom:

Highest Longword address is: FFFFFFFC(X)
'No arrays available for test. Skipping test' message printed.

Fix:

Do not enable memory in slot <7>

OR

Set last memory to equal 1/2 populated by adding wiring S1-3 to S1-6.

OR

Get proper patch from DEC.

B. Syndrome bits do not give proper summary.

Symptom·

Single bit errors show in array testing but summary only lists error in syndrome 00.

Fix:

Get proper patch fix from DEC.

RUN EXAMPLE #1

```
>>>1
>>>B/10 DMA0
%%

DIAGNOSTIC SUPERVISOR. ZZ-ECSAA-6.0-148  21-FEB-1981  09:46:15
DS> ATT MS750 CMI MS0
DS> SEL MS0
DS> RUN  ECKAM

>> PROGRAM: ECKAM-REV. 2.1  MS750 MEMORY DIAGNOSTIC, REV. 1.2, 11 TESTS, AT 09:46.45.

HIGHEST LONGWORD ADDRESS IS: 003FFFC(X)
MEMORY MAP VALID: 00000FFF(X) 00000FAA  For L0016 Controller
SLOT (0) IS FULLY POPULATED   (1024Kb)
SLOT (1) IS FULLY POPULATED   (1024Kb)
SLOT (2) IS FULLY POPULATED   (1024Kb)
SLOT (3) IS FULLY POPULATED (256KB)
SLOT (4) IS FULLY POPULATED (256KB)
SLOT (5) IS FULLY POPULATED (256KB)
SLOT (6) IS EMPTY
SLOT (7) IS EMPTY
ROM NUMBER: A  DEVICE TYPE: DD
ROM NUMBER: B  DEVICE TYPE: DM
ROM NUMBER: C  DEVICE TYPE: DL
ARRAY (1) SINGLE BIT ERRORS:
    ROW 1  -  0
    ROW 2  -  0
    ROW 3  -  0
ARRAY (2) SINGLE BIT ERRORS:
    ROW 0  -  0
    ROW 1  -  0
    ROW 2  -  0
    ROW 3  -  0
ARRAY (3) SINGLE BIT ERRORS:

    ROW 0  -  0
    ROW 1  -  0
    ROW 2  -  0
    ROW 3  -  0
ARRAY (4) SINGLE BIT ERRORS:
    ROW 0  -  0
    ROW 1  -  0
    ROW 2  -  0
    ROW 3  -  0
ARRAY (5) SINGLE BIT ERRORS:
    ROW 0  -  0
    ROW 1  -  0
    ROW 2  -  0
    ROW 3  -  0
THERE WERE NO CORRECTABLE ERRORS

>>>END OF RUN.  0 ERRORS DETECTED.  PASS COUNT: 1.  TIME: 21-FEB-1981  10:04:33.46
```

RUN EXAMPLE #2

"SET TRACE"

```
>>>B/1C DMA0
^C

DIAGNOSTIC SUPERVISOR.  ZZ-ECSAA-6.1-175     5-AUG-1981 17:38:58
DS> attms750 cmi ms0
DS> sel ms0
DS> set trace
DS> run eckam

.. PROGRAM: ECKAM-REV. 2.1  MS750 MEMORY DIAGNOSTIC, REV 1.2, 11 TESTS, at 17:39:24.34

HIGHEST LONGWORD ADDRESS IS: 002EFFC(X)
TEST 1: MEMORY MAP VERIFICATION TEST
MEMORY MAP VALID:m 000000AA    FOR L0016 Controller
SLOT[0] IS FULLY POPULATED   (1024 Kb)
SLOT[1] IS FULLY POPULATED   (1024 Kb)
SLOT[2] IS FULLY POPULATED   (1024 Kb)
SLOT[3] IS EMPTY
SLOT[4] IS EMPTY
SLOT[5] IS EMPTY
SLOT[6] IS EMPTY
SLOT[7] IS EMPTY
TEST 2: DATA BUS TEST
TEST 3: ROW SELECT BUS TEST
TEST 4: ADDRESS BUS TEST
TEST 5: ECC LOGIC TEST
TEST 6: CSRO TEST
TEST 7: BOOTSTRAP ROM TEST
ROM NUMBER: A  DEVICE TYPE: DD
ROM NUMBER: B  DEVICE TYPE: DM
ROM NUMBER: C  DEVICE TYPE: DL
ROM NUMBER: D  DEVICE TYPE: UM
TEST 8: CPU LOST ERROR TEST
TEST 9: CPU XB ERROR BIT TEST
TEST 10: MOVING INVERSIONS TEST
ARRAY[1] SINGLE BIT ERRORS:
    ROW 0  -  0
    ROW 1  -  0
    ROW 2  -  0
    ROW 3  -  0
ARRAY[2] SINGEE BIT ERRORS:
    ROW 0  -  0
    ROW 1  -  0
    ROW 2  -  0
    ROW 3  -  0
THERE WERE NOT CORRECTABLE ERRORS

>> END OF RUN.  0 ERRORS DETECTED.  PASS COUNT: 1.  TIME:  5-AUG-1981 17:47:42.92
DS> summary
THERE WERE NO CORRECTABLE ERRORS
DS>

^^
```

Device type 'UM' is an EMULEX Disk Controller

ERROR EXAMPLE #1

CORRECTABLE ERROR

```
>>>B/10 DMA0
%%

DIAGNOSTIC SUPERVISOR.  ZZ-ECSAA-6.1-175  5-AUG-1981 17:38:58
DS> attms750 cmi ms0
DS> sel ms0
DS> set trace
DS> run eckam
.. PROGRAM: ECKAM-REV. 2.1 MS750 MEMORY DIAGNOSTIC,REV 1.2, 11 TESTS, AT 17:50:27.37

HIGHEST LONGWORD ADDRESS IS:    002FFFC(X)
TEST 1: MEMORY MAP VERIFICATION TEST
MEMORY MAP VALID:  000000AA(X)
SLOT(0)  IS FULLY POPULATED    (1024  KB)
SLOT(1)  IS FULLY POPULATED    (1024  KB)
SLOT(2)  IS FULLY POPULATED    (1024  KB)
SLOT(3)  IS EMPTY
SLOT(4)  IS EMPTY
SLOT(5)  IS EMPTY
SLOT(6)  IS EMPTY
SLOT(7)  IS EMPTY
TEST 2: DATA BUS TEST
TEST 3: ROW SELECT BUS TEST
TEST 4: ADDRESS BUS TEST
TEST 5: ECC LOGIC TEST
TEST 6: CSR0 TEST
TEST 7: BOOTSTRAP ROM TEST
ROM NUMBER: A   DEVICE TYPE: DD
ROM NUMBER: B   DEVICE TYPE: DM
ROM NUMBER: C   DEVICE TYPE: DL
ROM NUMBER: D   DEVICE TYPE: UM
TEST 8: CPU LOST ERROR TEST
TEST 9: CPU XB ERROR  BIT TEST
ARRAY[1] SINGLED BIT ERRORS:
     ROW 0  -  0
     ROW 1  -  0
     ROW 2  -  0
     ROW 3  -  0
ARRAY [2] SINGLE BIT ERRORS:
     ROW 0  -  1
     ROW 1  -  0
     ROW 2  -  0
     ROW 3  -  0
NUMBER OF CORRECTABLE ERRORS = 1

ADDRESS (PAGE)          BIT NUMBER/SYNDROME

    00000000(X)              00(X)   (SYNDROME)          SEE SECTION 7.3.1, B

.. END OF RUN.  0 ERRORS DETECTED.  PASS COUNT: 1.  TIME: 5-AUG-1981 17:50:50.44

DS> summary

NUMBER OF CORRECTABLE ERRORS = 1

ADDRESS (PAGE)          BIT NUMBER/SYNDROME          SEE SECTION 7.3.1, B

  00000000(X)              00(X)   (SYNDROME)
DS>
```

Trendata CORPORATION	SIZE	CODE IDENT	NUMBER	REV
	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 7A-7

ERROR EXAMPLE #2

UNCORRECTABLE DOUBLE ERROR

```
00000000 16
>>>I
>>>B/10 DMA0
%%

DIAGNOSTIC SUPERVISOR. ZZ-ECSAA-6.0-148  21-FEB-1981 10:19:17
DS> ATT MS750 CMI MS0
DS> SEL MS0
DS> RUN ECKAM

.. PROGRAM: ECKAM-REV. 2.1 MS750 MEMORY DIAGNOSTIC, 1.2, 11 TESTS, AT 10:19:39.18.

HIGHEST LONGWORD ADDRESS IS: 002FFFFC(X)
MEMORY MAP VALID: 000000AA(X)
SLOT(0) IS FULLY POPULATED  (1024 KB)
SLOT(1) IS FULLY POPULATED  (1024 KB)
SLOT(2) IS FULLY POPULATED  (1024 KB)
SLOT(3) IS EMPTY
SLOT(4) IS EMPTY
SLOT(5) IS EMPTY
SLOT(6) IS EMPTY
SLOT(7) IS EMPTY
********  ECKAM-REV. 1.2  MS750 MEMORY DIAGNOSTIC - 1.2 ********
 PASS 1  TEST 6  SUBTEST 1  ERROR 1   21-FEB-1981 10:19:53.82
 HARD ERROR WHILE TESTING UNKNOWN DEVICE:   SUBSYSTEM FAILURE

UNEXPECTED UNCORRECTABLE ERROR OCCURRED
ADDRESS REFERENCED: 000B2400(X)
CONTENTS OF THE MEMORY CSR'S
  CSR0 - 800B242E(X)   ; UCE, PAGE ADDR=0592(X),SYNDROME=2E(X)
  CSR1 - 100B2464(X)   ; ERCE,PAGE ADDR=0592(X),CHECK BITS=64(X)
  CSR2 - 0000003F(X)   ; STARTING ADD=00(X),MEMORY MAP=003F(X)
```

NOTE: THE LISTED SYNDROME OF 2E IS NOT LISTED IN THE SYDROME TABLE AND IS THEREFORE AN UNCORRECTABLE ERROR. THE PAGE ADDRESS 0592 IS WITHIN THE RANGE OF THE SLOT (2) MEMORY 0400 TO 05FF.

HELP EXAMPLE

```
>>>H
>>>S

^C
DS> H

 HELP

   Help can be obtained on a particular topic by typing:
      HELP topic subtopic subsubtopic (etc...)
   A topic can have the following formats:
   1)  An alphanumeric string (e.g., a command name, option)
   2)  Same, preceded by a "/" (interpreted as qualifier)
   3)  As in 1) or 2), with embedded "*" or "%" to specify
       wildcarded topic
        o  "*" matches anything
        o  "A*" matches all words beginning with "A"
        o  "*A" matches all words ending with "A"
        o  "A*A" matches all words beginning and ending with "A"
        o  "*A*" matches all words containing an "A"
        o  "A%C" matches any 3-character word beginning with "A"
           and ending with "C"

   4)  Any of the above followed by "..", causing all remaining
       topic levels to act as if they were "*".
   5)  The first topic may be a diagnostic program name, in which
       case all following topic keys are promoted (subtopic becomes
       topic, etc.) and help text is extracted from the appropriate
       diagnostic help file.

   Abbreviations (which do not include wildcarded characters)
   result in all matches being displayed.

   Examples:
       HELP
       HELP ATTACH *
       HELP EVRAA DEVICE...

   Addtional information available:

   ABORT    ATTACH    CLEAR    CONTINUE      CONTROL-C      DEPOSIT
   DESELECT           DEVICE   EXAMPLE HELP  LOAD    NEXT   RUN    SET
   SELECT   SHOW      SPECIFY START    SUMMARY SCRIPT
```

8.0 RAM REPLACEMENT

8.1 PRELIMINARY INFORMATION

The MM-140 is designed to allow simple field replacement of the RAM chips. Section 6 defines the warranty information relative to the MM-140 and should be read before undertaking any action.

8.2 KEY TABLES

If it becomes necessary to replace a defective RAM on the MM-140, the following key information points are required before attempting the replacement. Can you:

a. Locate the failure to the level of a single array board.? (See Table C).

b. Locate the bit in error or the syndrome code for that bit? (See Table B).

c. Locate the page address of the bit in error to get a single RAM failure? (See Table C).

If any of the above questions cannot be answered, it normally is not possible to field repair an MM-140.

8.3 DIAGNOSTICS VS. ERROR LOGS

Two main sources of information exist on a VAX system which will provide the answer to the three questions. They are the System Error Log Program and the diagnostic tests.

8.3.1 System Error Log

The basic operation and example of the system error is contained in Section 9 for VMS and UNIX users.

When using VMS, you should ask for the SYE report and request 'Standard" class errors. This information plus the syndrome bit, Table B in Section 8.4, should allow you to answer the three key questions. Then, use Section 8.5 to find the exact procedure to replace a defective RAM.

8.3.1 (Continued)

If you are using UNIX 32V or VM UNIX, the information necessary to locate the failure may have to be obtained by operator intervention.

The Memory Configuration Registers 0, 1 and 2 should contain all necessary information. (See pages 8-3 to 8-5).

In both cases, several errors should be listed to confirm the failure.

8.3.2 DIAGNOSTICS

The memory diagnostics and other memory tests can provide the information necessary to answer the three key questions of paragraph 8.2. Section 7 of this manual contains the diagnostic operational procedures. It may also be possible to do a manual examination of the Memory Controller Configuration Registers after an unexpected error.

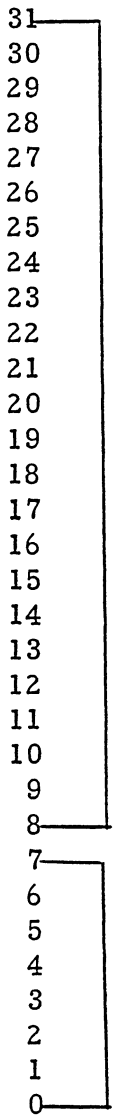
VAX 11/730
CSR 0 Fig. 4
CSR 1 Fig. 5
CSR 2 Fig. 6

VAX 11/750
CSR 0 Fig. 7
CSR 1 Fig. 8
CSR 2 Fig. 9

VAX 11/730

CSR 0

BIT LIST



Not Used

ECC Syndrome Bits
See Table B

VAX 11/730
CSR0
Figure 4

Trendata CORPORATION	SIZE	CODE IDENT	NUMBER	REV
	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 8-3

VAX 11/730

CSR 1

BIT LIST

31 — Uncorrectable Read Error
30 — Correctable Read Error
29 — Translation Buffer Parity Diagnostic Error
28 — Inhibits Reporting CRD's
27 — Memory Management Enable
26 — Memory Controller in Diag. Mode
25 — Disables ECC Logic
24 — Not Used
23 — Modify Ref.
22 — Access Ref.
21 — Translation Buffer Miss.
20 — Illegal Unibus Operation
19 — Write Across Page Boundary Error
18 — Adapt Reg. Select
17 — Unibus Busy
16 — Non-Existent Memory Array Accessed
15 — Translation Buffer Parity Error
14 — Valid
13, 12, 11, 10, 9, 8, 7 — Not Used
6, 5, 4, 3, 2, 1, 0 — Diagnostic Check Bits

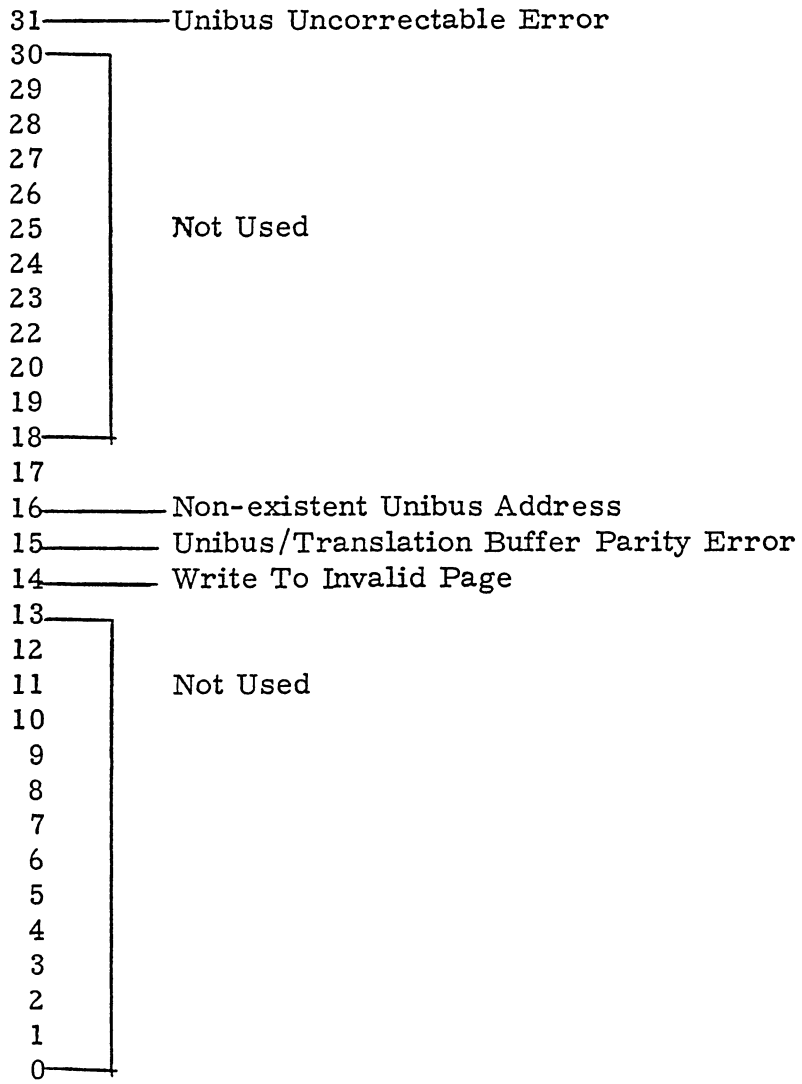
VAX 11/730
CSR 1
Figure 5

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 8-4

VAX 11/730

CSR 2

BIT LIST



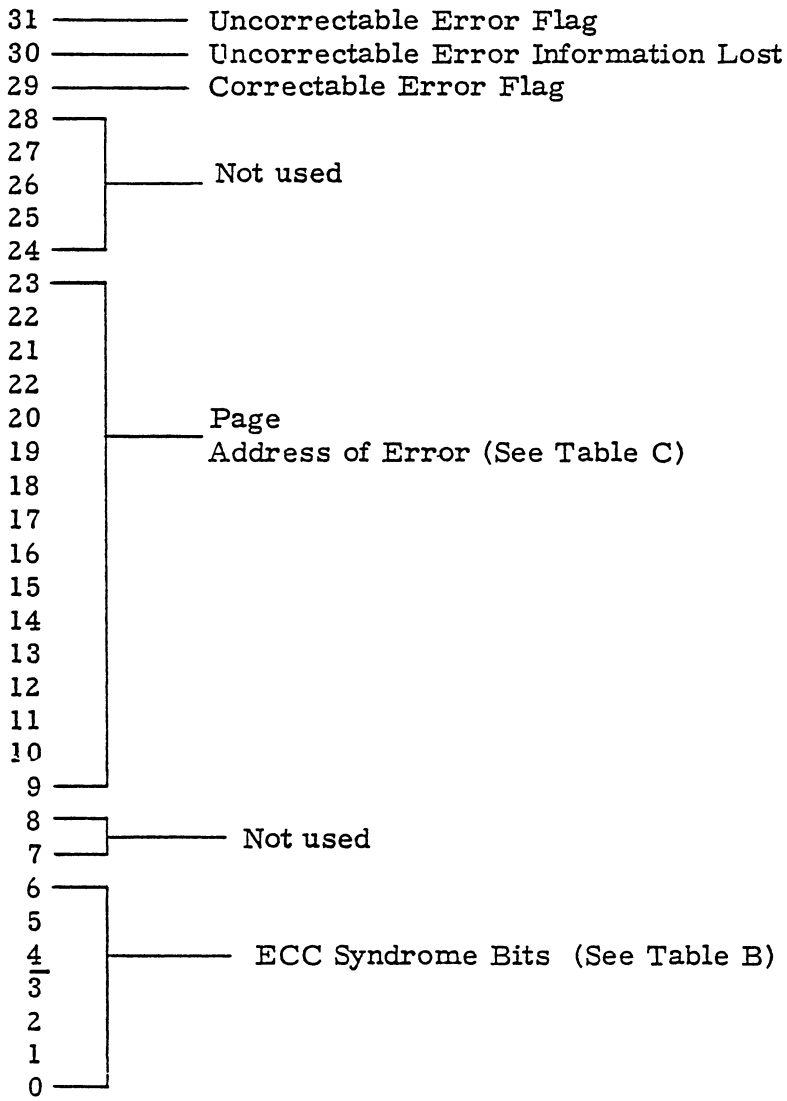
VAX 11/730
CSR 2
FIGURE 6

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 8-5

VAX 11/750

MEMORY CSR 0 REGISTER
BIT LIST

Register 0
F20000



Bit 0:7 9:23 are read ONLY.

NOTE: Unused bits read as zero.

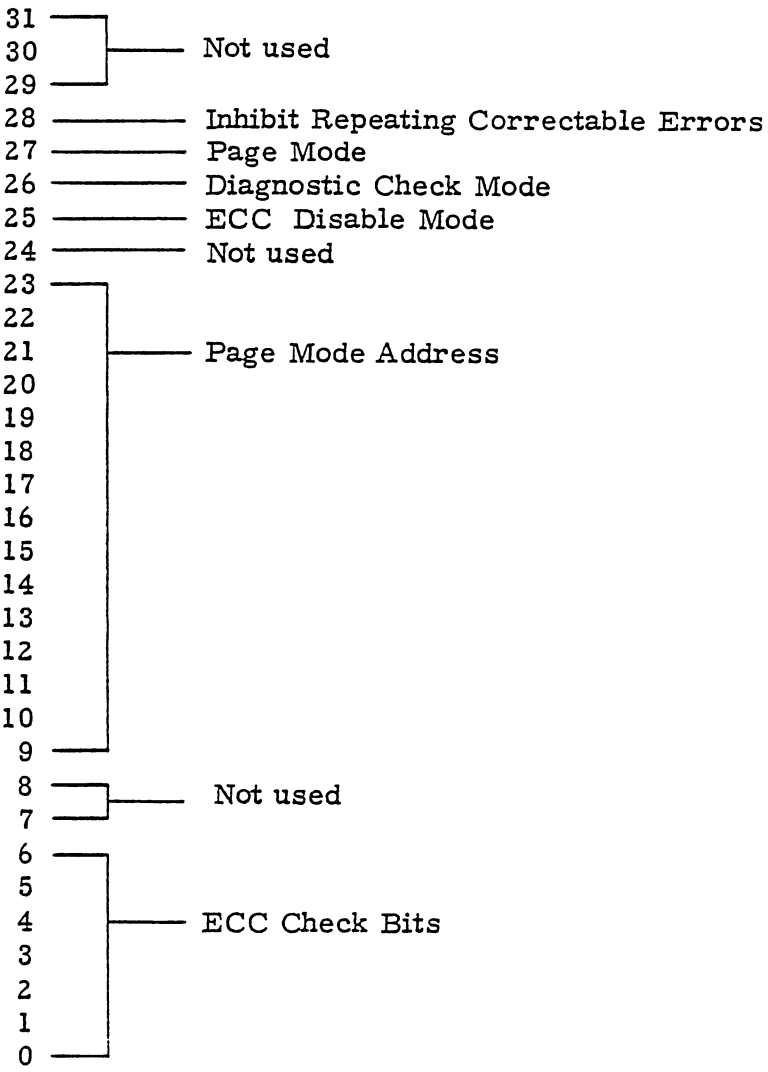
FIGURE 7 VAX 11/730 CSR 0

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 8-6

VAX 11/750

MEMORY CSR REGISTER #1
BIT LIST

Register 1
F20004



NOTE: Unused bits read as zero.

VAX 11/750
CSR 1

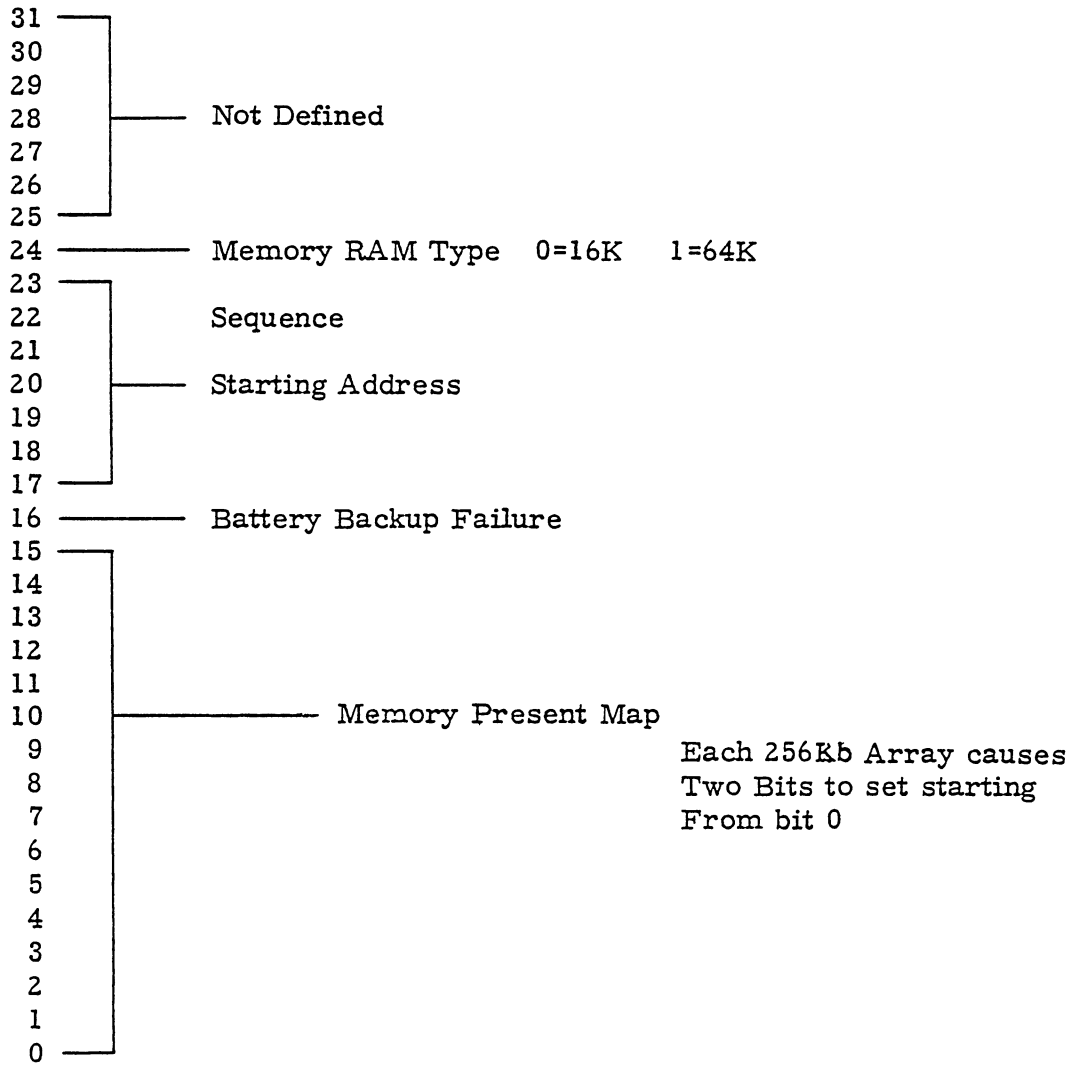
FIGURE 8

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 8-7

VAX 11/750

MEMORY CSR REGISTER 2
BIT LIST

Register 2 at
2F0008



NOTE: Unused bits read as zero.

FIGURE 8 VAX 11/750 CSR 2

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet 8-8

Trendata CORPORATION

SIZE	CODE IDENT	NUMBER	REV
A	29737	SC 2825	NC

SCALE: ——— TC-1011 (5/80) Sheet 8-9

Table A

RAM LOCATION CHART

	DB23	DB22	DB21	DB20	DB19	DB18	DB17	DB16		DB31	DB30	DB29	DB28	DB27	DB26	DB25	DB24
BYTE 2	U1	U2	U3	U4	U5	U6	U7	U8	ROW D	U9	U10	U11	U12	U13	U14	U15	U16
	U17	U18	U19	U20	U21	U22	U23	U24	ROW C	U25	U26	U27	U28	U29	U30	U31	U32
	U33	U34	U35	U36	U37	U38	U39	U40	ROW B	U41	U42	U43	U44	U45	U46	U47	U48
	U49	U50	U51	U52	U53	U54	U55	U56	ROW A	U57	U58	U59	U60	U61	U62	U63	U64

	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8
BYTE 0	U65	U66	U67	U68	U69	U70	U71	U72	ROW D	U73	U74	U75	U76	U77	U78	U79	U80
	U81	U82	U83	U84	U85	U86	U87	U88	ROW C	U89	U90	U91	U92	U93	U94	U95	U96
	U97	U98	U99	U100	U101	U102	U103	U104	ROW B	U105	U106	U107	U108	U109	U110	U111	U112
	U113	U114	U115	U116	U117	U118	U119	U120	ROW A	U121	U122	U123	U124	U125	U126	U127	U128

	CBT	CB32	CB16	CB8	CB4	CB2	CB1	
CHECK BITS	U129	U130	U131	U132	U133	U134	U135	ROW D
	U136	U137	U138	U139	U140	U141	U142	ROW C
	U143	U144	U145	U146	U147	U148	U149	ROW B
	U150	U151	U152	U153	U154	U155	U156	ROW A

U157	U158	U159	U160	U161	U162	U163	U164	
U165	U166		U167	U168	U169	U170	U171	
U172	U173	U174	U175	U176	U177	U178	U179	
U180	U181		U182	U183				
U184	U185	U186	U187	U188	U189	U190	U191	

SYNDROME BITS
TABLE B

This Figure shows decoding of the CSR which allows you to determine which single bit was in error.

ECC Code	Data Bit	ECC Code	Data Bit
01	CB1	3B	DB27
02	CB2	3D	DB29
04	CB4	3E	DB30
08	CB8	40	CBT
10	CB16	5B	DB3
19	DB1	58	DB0
1A	DB2	5D	DB5
1C	DB4	5E	DB6
1F	DB7	60	DB13
20	CB32	68	DB8
29	DB9	6B	DB11
2A	DB10	6E	DB14
2C	DB12	70	DB16
2F	DB15	73	DB19
31	DB17	75	DB21
32	DB18	76	DB22
34	DB20	77	DB31
37	DB23	79	DB25
38	DB24	7A	DB26
		7C	DB28

NOTES

1. Syndrome codes not listed in Table B are multiple errors and are not correctable or easily traceable.
2. VAX 11/750
   Bit 29 of CSR 0 must be set for the syndrome codes to be valid. If Bit 31 of CSR 0 is set, the problem is an uncorrectable one.

2.A VAX 11/730
   Bit 30 of CSR 1 must be set for Syndrome Codes to be valid. If Bit 31 of CSR 1 is set, the problem is an uncorrectable one.

3. Code value shown may also be shown as Code $+80_{16}$ i.e., 29 can also be A9.

8.4 RAM REMOVAL PROCEDURE

In order to change a single RAM, no special precaution is necessary in most cases:

(1) Power down the system and the box controller battery power.

(2) Carefully pull out the memory chassis. See installation procedure.

(3) Remove the cover.

(4) Remember that most boards in the VAX 11/750 chassis are on 1/2 inch centers. Removal or re-insertion must be done with special care. Use the ejector handle to slowly remove the failing array.

(5) Carefully grasp the failing array board in one hand; thus, grounding yourself to the board.

(6) Use a chip puller, small screw driver or a knife to lift the RAM from its socket.

(7) Replace it with the spare RAM.

(8) Double check your work for bent over chip pin or improper insertion. Also check proper orientation.

(9) Carefully replace the array card in its original slot.

(10) Power up the box controller battery switch and the system.

(11) Rerun the diagnostic to verify you have found the failing chip.

(12) If the diagnostic runs without error, take at least 1 pass before continuing or if the diagnostic still fails, return to start and try again.

(13) Replace the cover. Return the memory chassis to its proper position and replace the door.

TABLE C
ADDRESS MAP
VAX 11/750 -442 (750S)

Page Address	Array Address
0: 03FF	0
0400: 07FF	1
0800: 0BFF	2
0C00: 0FFF	3
1000: 13FF	4
1400: 14FF	5
1800: 1BFF	6
1C00: 1FFF	7

Page Address	Row
Page +0 to Page +0FF	A
Page +100 to Page +1FF	B
Page +200 to Page +2FF	C
Page +300 to Page +3FF	D

VAX 11/750 -443 (730 or 750S+)

Page Address	Array Address
0: 0FFF	0
1000: 1FFF	1
2000: 2FFF	2
3000: 3FFF	3
4000: 4FFF	4
5000: 5FFF	5
6000: 6FFF	6
7000: 7FFF	7

Page Address	
Page +0 to Page +3FF	A
Page +400 to Page +7FF	B
Page +800 to Page BFF	C
Page +C00 to Page FFF	D

9.0 OPERATING SYSTEMS

9.1 VMS

VMS is the Digital Equipment supplied operating system for the VAX computers.

9.1.1 Error Logging

A very useful utility program on the VMS system is the Error Logging Program. It is recommended that you run this program and keep proper error log record in case there is any problem with the system.

The program UTILITY SYE is used to format the error log output.

Five options are available:

R	Roll up	Default Option
C	Cryptic	
B	Brief	
S	Standard	
U	Unknown	

The Default Option, roll up, is a summary report of the total number of errors.

The brief option, B, includes a description of each error.

The cryptic option, C, applies to device and CP class hardware errors; it includes the register data but no explanation of the register data, hence, the cryptic title.

The standard option, S, includes all data plus an English language explanation.

The unknown option, U, covers all other unrecognized errors.

Sample from SYE

9.2 USING BRIEF OPTION

```
Username: SYSTEM
Password:
        Welcome to VAX/VMS Version V2.3
$ SET DEF [SYSERR]
$ MCR SYE

SYE VERSION 2.5

_INPUT FILE      [  [SYSERR]ERRLOG.OLD  ]   ?
_OUTPUT FILE     [SYS$OUTPUT]               ?BRIEF.LIS*
_OPTIONS         [ROLL-UP]                  ?B
_DEVICE NAME     [<CR>]                     ?
_AFTER DATE      [FIRST ENTRY]              ?
-BEFORE DATE     [LAST ENTRY]               ?

%SYE-I-SUCCOM, SUCCESSFUL COMPLETION
```

This sequence produces a short system error report as in Entry 3 and 4.

```
******************************* ENTRY    3. *****************************
MEMORY ERROR                               LOGGED 17-NOV-1981 17:25:10.14
ERROR SEQUENCE 21.                         SYSTEM ID REGISTER

      CPU TYPE KA750     MIC REV# 52.   H/W REV# 255.

SI 0  CSR0      CSR1      CSR2

      2007CB58 10000000 00000FFF
******************************* ENTRY    4. *****************************
MEMORY ERROR                               LOGGED 17-NOV-1981 17:25:11.04
ERROR SEQUENCE 22.                         SYSTEM ID REGISTER

      CPU TYPE KA75C     MIC REV#52.     H/W REV# 255.

SI 0  CSR0      CSR1      CSR2

      2007CB58 100000000 6E000FFF
******************************* ENTRY    5. *****************************
```

*The information contained can also be seen in a more informative way by getting "STD. LIS" option, the decode of CSR0, 1 and 2 will show the error. Refer to Section 8 for CSR bit information.

9.3 STANDARD OPTION

This sequence produces a readable error report.

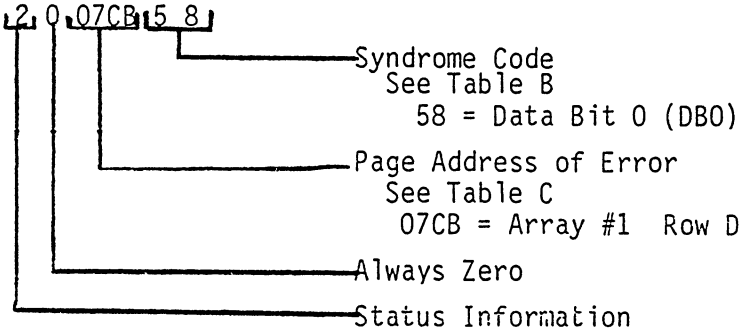
```
$ MCR SYE

SYE VERSION 2.5

_INPUT FILE     [   [SYSERR[ERRLOG.OLD  ]  ?
_OUTPUT FILE    [SYSSOUTPUT]               ?STD>LIS\
_%RMS-I-TYP, error in file type
_OUTPUT FILE    [SYSSOUTPUT]               ?STD.LIS
_OPTIONS        [ROLL-UP]                  ?S
_DEVICE NAME    [<CR>]                     ?
_AFTER DATE     [FIRST ENTRY]              ?
_BEFORE DATE    [LAST ENTRY]               ?

%SYE-I-SUCCOM, SUCCESSFUL COMPLETION
```

All the information required to analyze asingle bit error is easily obtained from this listing in Entry 5.

```
V A X / V M S     SYSTEM ERROR REPORT     COMPILED 18-NOV-81 12:37
                                                        PAGE 2.

****************************** ENTRY   5.******************************
MEMORY ERROR                             LOGGED 17-NOV-1981 17:25:10.14
ERROR SEQUENCE 21.                       SYSTEM TO REGISTER     20034FF

      CPU TYPE KA 750   MIC REV# 52.  H/W REV# 255.

ADAPTER SLOT NUMBER = 0.

ADAPTER REGISTERS

      CSR 0             2007CB58
                                       ERROR SYNDROME = 58
                                       CRO ERROR (CORRECTED BIT = 0.)
                                       ARRAY IN ERROR = 1.
                                       CRO ERROR LOG REQUEST

      CSR 1             10000000
                                       ENABLE ERROR STATUS
      CSR 2             00000FFF
                                       MEMORY STARTING ADDRESS = 0.K
```

Key points for either standard or brief 'Memory Errors'.

CSR0



All numbers base 16 DB0 in Row D - U72

(See CSR bit definitions for remaining bits). See Table A

9.4 UNIX 32V, trademark of Bell Telephone and VM UNIX trademark of the University of California, Berkeley, are other operating systems.

Bell UNIX V4 has error logging capability. Sample error CRDO ERRCO < > lists CSRO Register. VM UNIX also has error logging in the form of MEMERR <C Reg.> See Table B and Section 8.5.

9.5 REFERENCE GUIDE

VAX 11/750	Diagnostic System Overview Digital Equipment EK-VXD75-UG-001
VAX 11/750	Memory System Technical description Digital Equipment EK-MS750-TO-001
VMS	System Guide Digital Equipment
UNIX 32V	Bell System Software P. O. Box 25000 Greensboro, NC 27420
VM UNIX	University of California Berkeley Berkeley, CA

SECTION 10.0

CONSOLE OPERATIONS

VAX 11/750

10.0 CONSOLE OPERATION

All you may ever want to know about the system operation can be found by printing the file: (SYSMAINT) COMETMAN.SEQ;1 from the VMS disk.

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APPENDIX A

SITE NOTES

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APPENDIX A

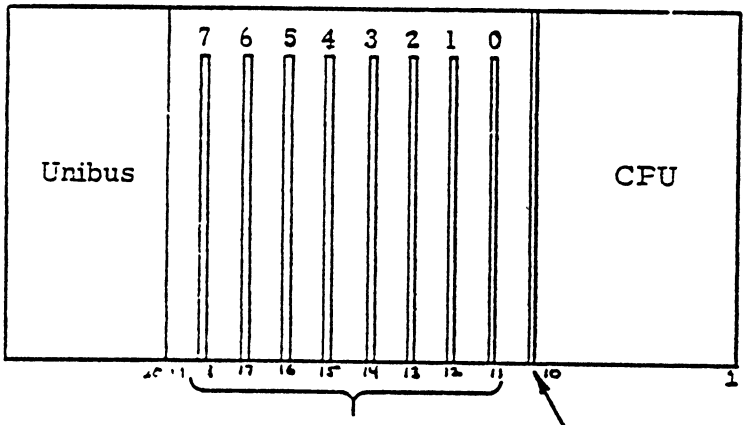
SITE RECORD NOTES
VAX 11/750

Customer _____ System # _____

Installer _____ Date _____

1. Site verification diagnostics Pass ☐ Fail ☐

2. Mark installed modules Slot #



3. Memory Size

A. Original Size _____ Kb

B. Upgrade Size _____ Kb

C. New System Size
a + b = c _____ Kb

4. Mark initial Switch Set-Up

On Line/Off Line On ☐ Off ☐

☐ ☐

_____

Trendata CORPORATION	SIZE	CODE IDENT	NUMBER	REV
	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet A-2

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APPENDIX A -1

SITE RECORD NOTES
VAX 11/730

Customer _____ System # _____

Installer _____ Date _____

1. Site verification diagnostics Pass ☐ Fail ☐

2. Mark installed modules Slot # _____

1	RB 730 Disk Controller	
2	FP 730	
3	CPU Data Path	
4	Memory Controller	
5	WCS	
6	Memory #1	
7	Memory 2	
8	Memory 3	
9	Memory 4	
10	Memory or Peripheral 5	
11	DMF-32	
12	Terminator	Quad Slot

3. Memory Size

A. Original Size _____ Kb

B. Upgrade Size _____ Kb

C. New System Size
a + b = c _____ Kb

4. Mark initial Switch Set-Up

On Line/Off Line On ☐ Off ☐

☐ ☐

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC2825	NC
	SCALE:		TC-1011 (5/80)	Sheet A-3

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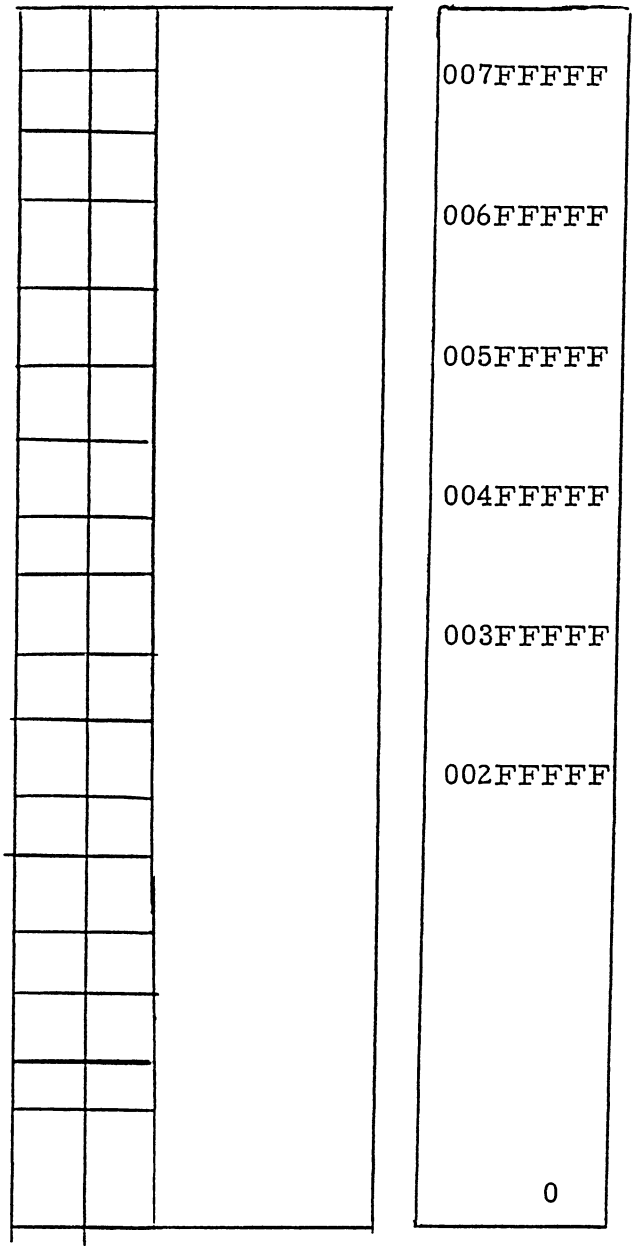
MEMORY ALLOCATION TABLE #1

DEC Cards	TRENDATA MM-140 Cards	Slot



32 Bit Words
Highest Long Word Address

	SIZE	CODE IDENT	NUMBER	REV
Trendata CORPORATION	A	29737	SC 2825	NC
	SCALE:		TC-1011 (5/80)	Sheet A-4

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APPENDIX B

DRAWINGS
MM 140

PARTS LIST - P/L 102415

ASSEMBLY - 102415

SCHEMATIC - 102417

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		DATE
PREPARED	R. Flaig	2/8/79
CHECKED	E. Lackey	4/11/79
PROJ ENGR	A. Egan	4/24/79
APPROVED	E. Worley	4/24/79

Trendata CORPORATION
SANTA ANA, CALIFORNIA
CODE IDENT 29737

PL 102415
PARTS LIST
ASSEMBLY TITLE
ASSEMBLY
MM-140

REV ∈
REV DATE
REV AUTH
SHEET 1 OF 1

Version 402 Basic board with sockets, partial assembly
403 Basic board with sockets, partial assy
442 Basic board with sockets and RAMs
443 Basic board with sockets & RAMs
042 Basic no sockets soldered in RAMs
043 Basic no sockets soldered in RAMs
16K RAM
64K RAM

	-402		-042		-442		-403		-043		-443					
	REV DATE		REV DATE		REV DATE		REV DATE		REV DATE		REV DATE					
	QTY		QTY		QTY		QTY		QTY		QTY					
ITEM	EACH	EXT	EACH	EXT	EACH	EXT	EACH	EXT	EACH	EXT	EACH	EXT	REFERENCE DESIGNATION	DESCRIPTION	SMI PART NO OR SPEC NO	
1	1		1				1		1					Fab. Detail, MM-140	102416-001	Rev. F & Up Artwork
2					1									Assy. MM-140	102415-402	
3											1			Assy. MM-140	102415-403	
4	1		1				1		1				U166	I.C. Quad 2 In NAND	SC1038-001	7400
5	1		1				1		1				U191	I.C. Quad 2 In NAND	SC1994-001	74S00
6	1		1				1		1				U179	I.C. Quad 2 In AND	SC2089-003	74S08
7	3		3				3		3				U161, U189, U190	I.C. Quad Buffer	SC2142-001	7428
8	3		3				3		3				U158, U162, U165	I.C. Quad 2 In NAND Buffer	SC1478-002	74S37
9	1		1				1		1				U177	I.C. Quad 2 In NAND Buffer	SC1477-001	7438
10	1		1				1		1				U159	I.C. Decoder	SC2110-001	74S138
11	6		6				6		6				U168, U169, U170, U172, U181, U183	I.C. Octal Buff/L. Drive/L. Reg	SC2543-002	74S240
12	10		10				10		10				U164, U171, U174, U175, U176, U184-188	I.C. Octal Buff/L. Drive/L. Reg	SC2543-001	74LS240
14	1		1				1		1				S2	Switch, Sub-Miniture, P.C. Mnt	SC2541-001	
16	-		-				4		4				R8-11	Resistor 22Ω±5% 1/4W	SC1249-002	
17	1		1										R4	Resistor, 47Ω ±5%, 1/4W	SC1249-004	
18	1		1										R5	Resistor, 270Ω ±5%, 1/4W	SC1249-023	
19	2		2				2		2				R6, R7	Resistor, 330Ω ±5%, 1/4W	SC1249-010	
20	3		3				3		3				R1, R2, R12	Resistor, 22Ω ±5%, 1/4W	SC1249-002	
21	5		5				5		5				U157, U160, U163, U180, U182	Resistor, Module 22Ω	SC2275-002	
22	1		1				1		1				U173	Resistor, Module 4.7K	SC1642-011	
23	1		1				1		1				U178	Resistor, Module 47K	SC1642-015	
24	1		1				1		1				R3	Resistor, 220Ω ±5%, 1/4W	SC1249-009	
25	1		1				1		1				RP1	Resistor Module SIP, 47K	SC3497-004	
26	1		1										CR1	Diode, Zener 1/2W, 5.1V	SC1676-005	1N5231B
27	1		1										CR2	Diode, Rectifier, 20V	SC2276-001	1N5817
28	1		1										CR3	Diode, Zener 1/2W, 6.8V	SC1676-002	1N5235B
29	2		2				2		2				LED 1, LED 2	LED, Red	SC1483-001	
31	163		163										C1-110, 111, 113, 115, 117, 119, 121, 123, 125, 127-147, 148, 150, 152, 154-156, 158-161, 163-176	Capacitor, .1µf +80% -20%, 50V	SC2556-001	
33							79		79				C16, 18, 20, 22, 24, 26, 28, 30, 31, 33, 35, 37, 39, 41, 43, 45, 48, 50, 52, 54, 56, 58, 60, 62, 63, 65, 67, 69, 71, 73, 75, 77, 80, 82 84, 86, 88, 90, 92, 94, 95, 97, 99, 101, 103, 105, 107, 109, 129, 131, 133, 135, 137, 139, 141, 143, 145, 147, 155, 156, 158-176	Capacitor, .1µf +80% -20%, 50V	SC2556-001	
36	18		18										C177, 179-195	Capacitor, 6.8µf, ±20%, 35V	SC1277-002	
38							10		10				C177, 180, 182, 184, 186, 187, 189, 191, 193, 195	Capacitor, 6.8µf, ±20%, 35V	SC1277-002	
39	2		2				2		2				C196, 197	Capacitor, 1000pf, ±10%, 50V	SC2152-004	
41	1		1				1		1					Bracket, Hold-down	SC2558-001	
42	12		12				12		12					Eyelet, Brass	SC1843-005	
43	158						158						Ref. Note 8	Sockets, 16 Pin	SC2579-001	
45	-		156		158								Ref. Note 7	I.C. 16K RAM	SC2532-003	
46							-		156		158		Ref. Note 7	I.C. 64K RAM	SC2745-003	
49	A/R		A/R		A/R		A/R		A/R		A/R			Wire, Jumper, 30 AWG	SC2737-001	
50	A/R		A/R		A/R		A/R		A/R		A/R			Wire, Buss, Tinned	SC1323 003	

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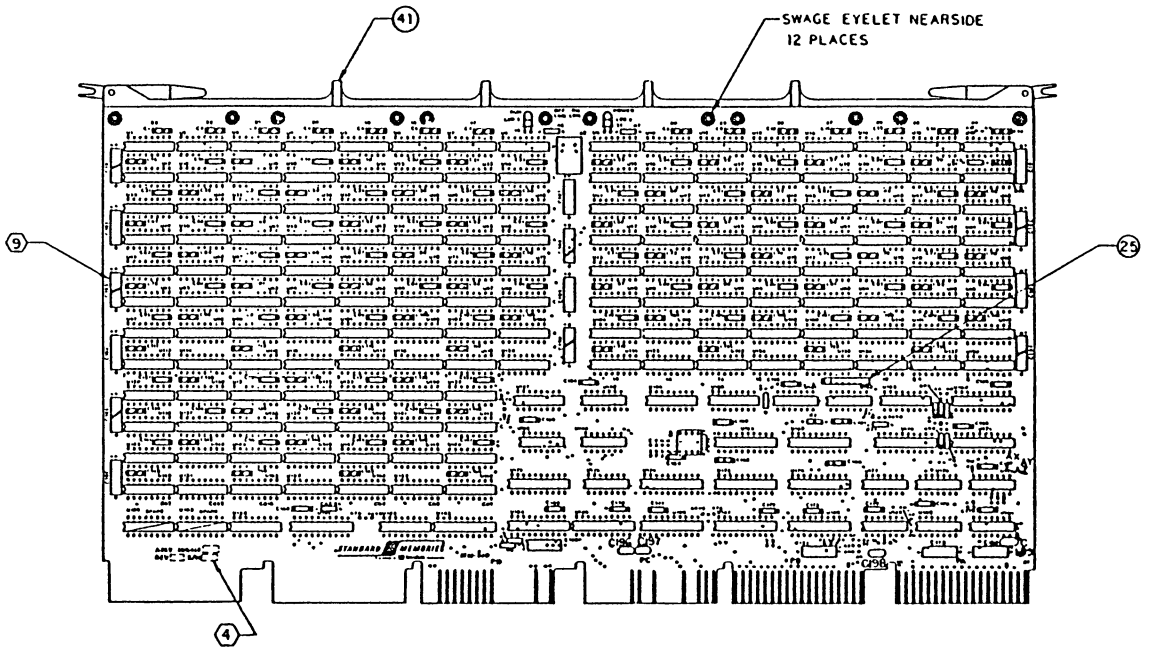

INSTALL JUMPERS FOR XX2 ONLY

Y ——— X AX ——— AZ
A ——— B
AB ——— AA
AR ——— AS
AJ ——— AL
AE ——— AF
AM ——— AN
AC ——— AD
+5VB ——— A7 4 PLACES
50

INSTALL JUMPER FOR XX3 ONLY

X ——— W
AV ——— AW
U ——— V
AR ——— AT
AL ——— AK
AE ——— AH
AM ——— AP
AC ——— AD
A7 ——— A7A A7D
50

+5VB A7 A7A-A7D

• JUMPER PADS FOR +5VB AND A7A-D

(11). ADDITIONAL CHANGES FOR ALL VERSIONS

10. ALL CAPS ARE USED ON 16K VERSION (XX3) EXCEPT C198 & 199.

(9) ALL CAPS ARE USED ON 64K VERSION (XX3) EXCEPT C198, C199 AND CAPS THAT ARE MARKED WITH SLASH

(8) USE (I.C. SOCKET, 16 PIN) SC2579-001 A/R FOR I.C. POSITION U1-U156, U192, U193.

(7) USE PREFERRED RAMS A/R FOR XX2 16K SC2532-003 AND XX3 64K SC2745-003. REF. DESIG. U1-U156.

6. MAX COMPONENT HEIGHT .330.

5. MAX LEAD PROTRUSION .045.

(4) PERMANENTLY STAMP REV. LETTER, DASH NO. AND SERIAL NO. APPROX WHERE SHOWN USING .12 HIGH CHARACTERS BLACK INK.

3. ASSEMBLE IN ACCORDANCE WITH TRENDATA Q.C. WORKMANSHIP STANDARD MANUAL.

2. REFERENCE PARTS LIST PL102415.

1. REFERENCE SCHEMATIC 102417 REV C.

NOTES: UNLESS OTHERWISE SPECIFIED —

102415 E

SEE PARTS LIST

DASH NO.	MODEL	DESCRIPTION	MATERIAL

DRN	R. FLAIG	3/79
CHK	E. LACKEY	4 79
ENG	A. EGAN	4/79
APPR	E. WORLEY	4/79

Trendata

P.C.B. ASSEMBLY

MM-140

SIZE	CODE IDENT	NUMBER	REV
D	29737	102415	E

SCALE FULL SHEET 1 OF 1

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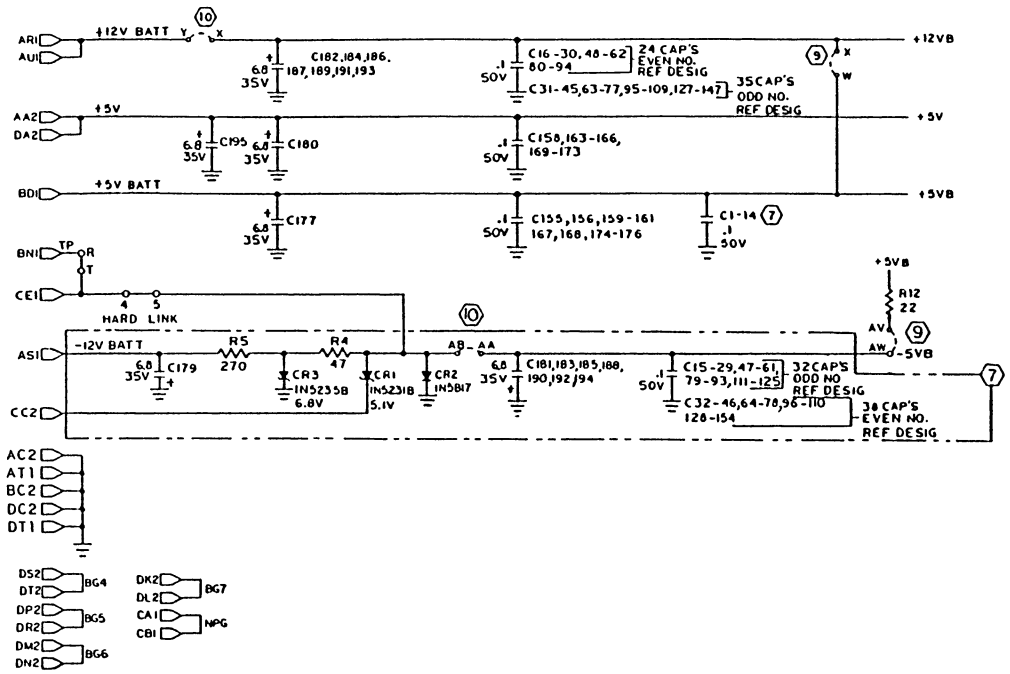

PIN	A-1	A-2	B-1	B-2	C-1	D-2
A	DBIIL	+5V	FNCP3L		NPG	+5V
B	DBIOL	MEM PRES L	WR BYT 1H	DB29L	NPG	
C	MAI5	GND	DB3CL	GND		GND
D	DB09L	MAI4	+5VB	DB28L		
E	REF CYC L	ADD MEM SEL L	WR BYT 0H	DBI9L	TP	
F	DB08L	A2H	DBI8L	DB03L		
H	AIH	DB27L	DBI7L	DBI6L		
J	DB26L	A3H	DRO2L	DB00L		
K	AOH	DB25L	CB0L	DB0IL	FNCPIL	BG7
L	DB24L	CS TIM L	CB2L	CB4L		BG7
M	CAS TIM L	DREN L	WR BYT 2H	CBIL	FNCP2L	BG6
N	DBI5L	WR TIM L	TP	INH CAS TIM L		BG6
P	A5H	DB3IL	DB07L	DB06L		BG5
R	+12VB	DBI4L	DB05L	DB04L		BG5
S	-12VB	RAS TIM L	DB23L	DB22L		BG4
T	GND	DBI3L		DB2IL		BG4
U	+12VB	DBI2L	DB20L	CBTL		
V	WR BYT 3H	A4H	CB32L	CBI6L		

DTI = GND
CC2 = TEST POINT

S2	
ON	OFF LINE
OFF	ON LINE

LED STATES	
LED I	ON = ACTIVE
LED 2	ON = +5B PRESENT

SPARES		
REF DESIG	I.C. TYPE	OUTPUT PINS
U191	74S00	11
U179	74S08	11
U161	7428	1,4,
U177	7438	3,6,8
U168	74S240	
U169	74S240	3,5,7,
U172	74S240	3,5,7,12
U181	74S240	
U187	74LS240	5,14
U173	1K	1,2,3,4,6,7
U178	47K	1,13
U192	16K RAM	—
U193	16K RAM	—

REFERENCE DESIGNATIONS	
LAST USED	NOT USED
R12	
C199	C112,114,116,118 120,122,124,126 149,151,153,157 162,178
U193	U167
CR3	

(11) COMPONENTS NOT USED: C198,199.
(10) INSTALL JUMPERS FOR 16K (XX2)
(9) INSTALL JUMPERS FOR 64K (XX3)
(8) NO RESISTORS (R8-R11) ON-442, JUMPERS CONNECT TO +5B
(7) NOT INSTALLED ON 64K VERSION (-003).
(6) JUMPER CONFIGURATION

VERSION 442	VERSION 443
AR-AS	AE-AH
AL-AJ	AM-AP
AE-AF	
AM-AN	

5. REF ASSEMBLY 102415 REV 'B'
4. SPARE RAMS, U192; U193, ALL PINS GROUNDED
(3) INPUT PINS ON SPARE GATES ARE GROUNDED
2. ALL CAPACITORS ARE IN MICRO-FARAD
1. ALL RESISTORS ARE IN OHMS, 1/4W, ± 5%
NOTE: UNLESS OTHERWISE SPECIFIED

DASH NO	MODEL	DESCRIPTION	MATERIAL
		INITIAL APPLICATION	

Trendata Corporation

SCHEMATIC DIAGRAM
MM-140

SIZE	CODE IDENT	NUMBER	REV
D	29737	102417	C

SCALE NONE SHEET 1 OF 9

102417 C

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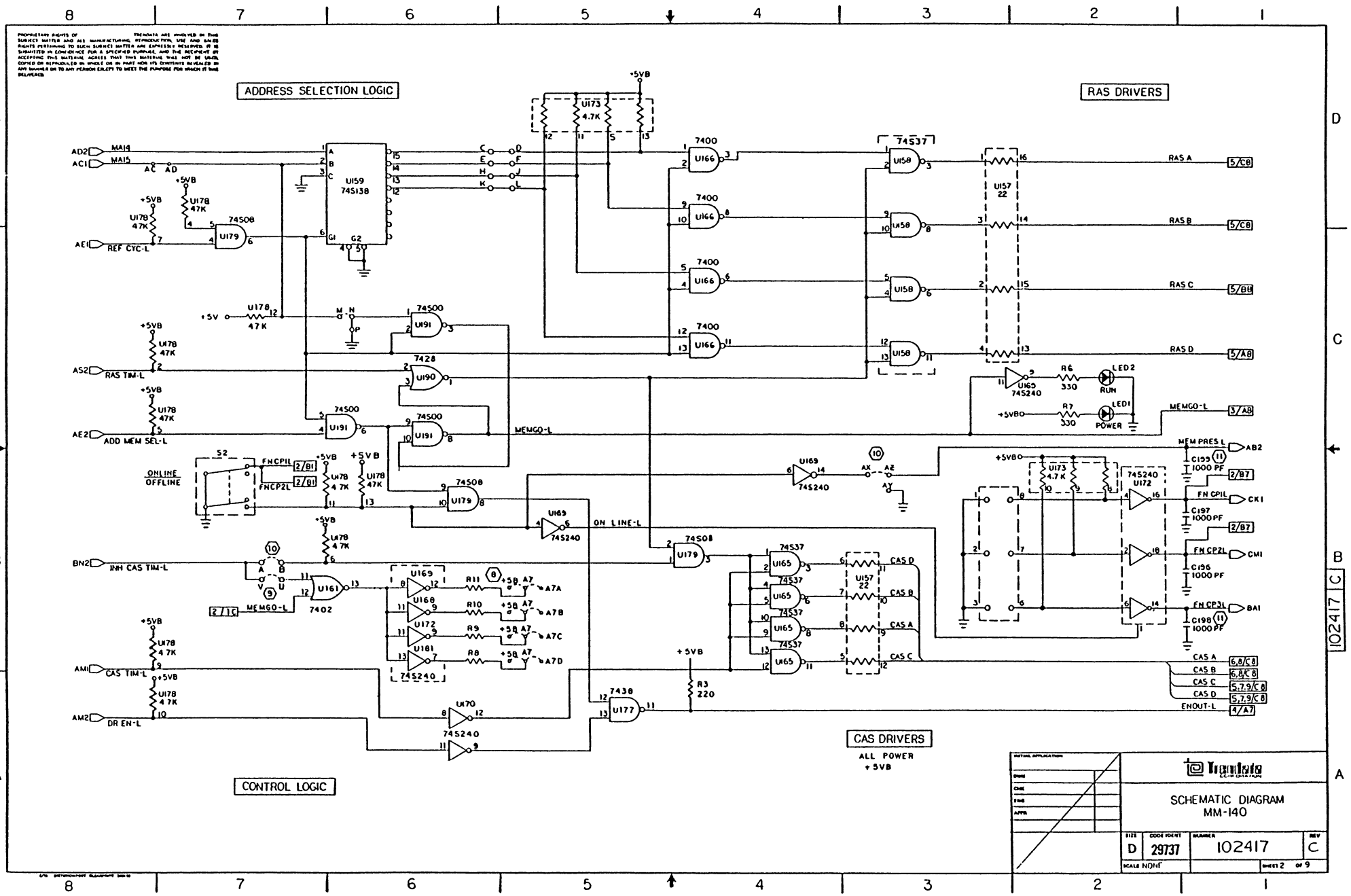
ADDRESS SELECTION LOGIC
RAS DRIVERS
CONTROL LOGIC
CAS DRIVERS
ALL POWER +5VB
SCHEMATIC DIAGRAM MM-140
Tandata
SIZE D
CODE IDENT 29737
NUMBER 102417
REV C
SCALE NONE
SHEET 2 OF 9
102417 C
RAS A
RAS B
RAS C
RAS D
MEMGO-L
ON LINE-L
CAS A
CAS B
CAS C
CAS D
ENOUT-L
MEM PRES L
FN CP1L
FN CP2L
FN CP3L
REF CYC-L
RAS TIM-L
ADD MEM SEL-L
INH CAS TIM-L
CAS TIM-L
DR EN-L
ONLINE
OFFLINE
RUN
POWER
U159 74S138
U169 74S240
U172 74S240
U161 7402
U177 7438
U158 74S37
U165 74S37
U157 22
U173 4.7K
U178 47K
U179 74S08
U191 74S00
U190 7428
U166 7400
R3 220
R4 330
R7 330
LED2
LED1

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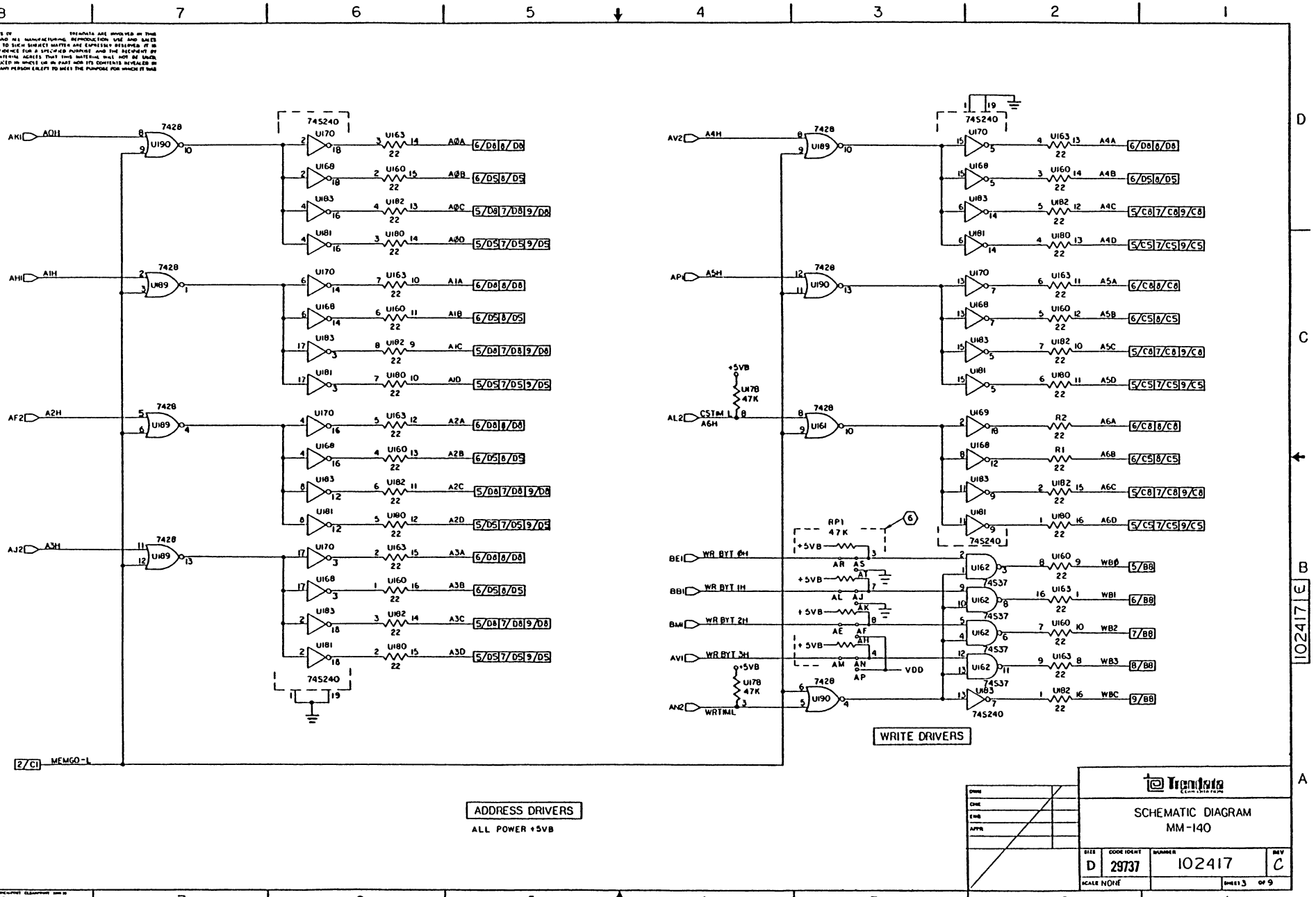
ADDRESS DRIVERS
ALL POWER +5VB
WRITE DRIVERS
SCHEMATIC DIAGRAM
MM-140
102417
C
D
29737
SCALE NONE
SHEET 3 OF 9

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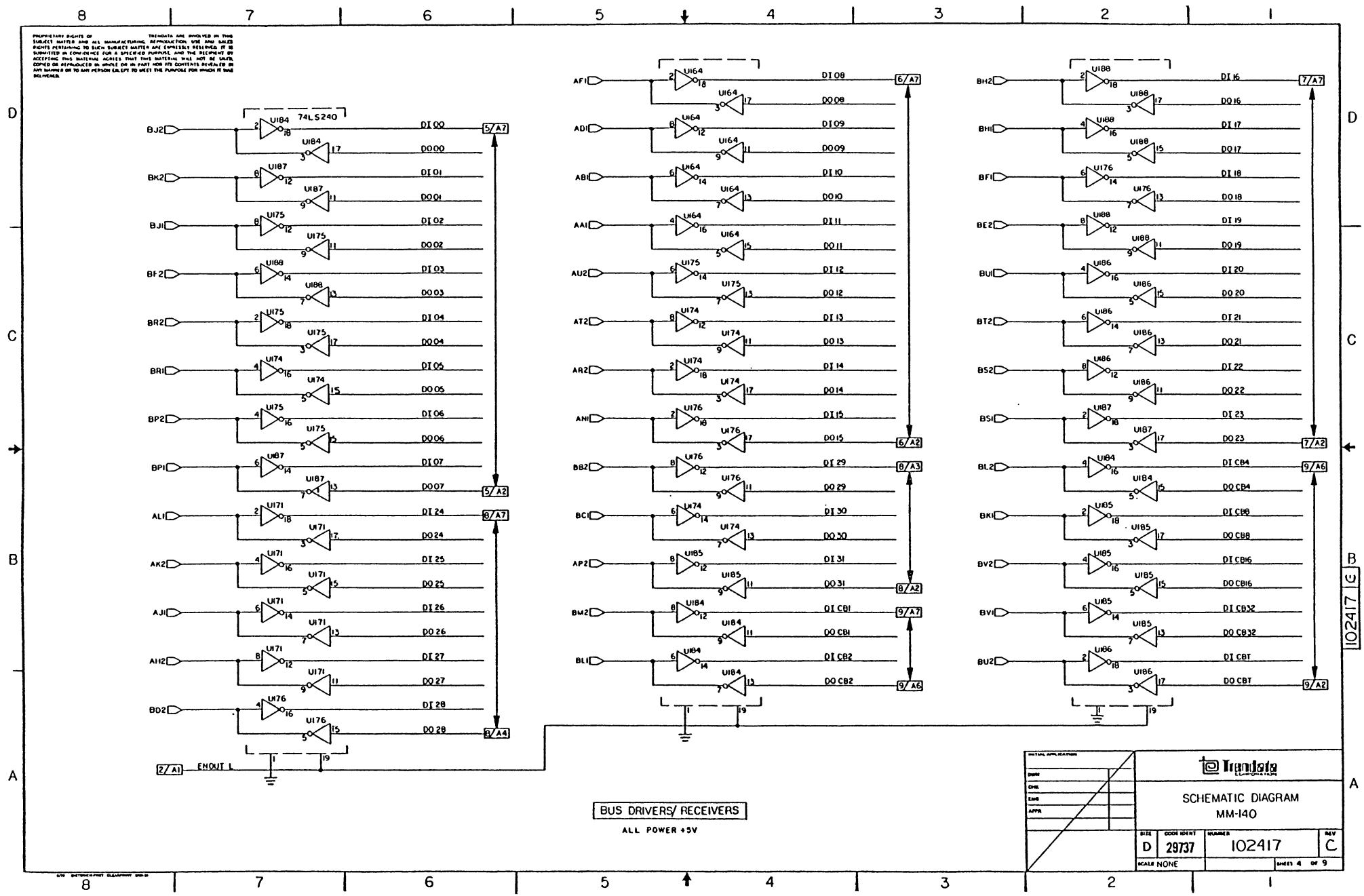
BUS DRIVERS/ RECEIVERS
ALL POWER +5V
SCHEMATIC DIAGRAM
MM-140
Tandata
D
29737
102417
C
SCALE NONE
SHEET 4 OF 9
102417 C

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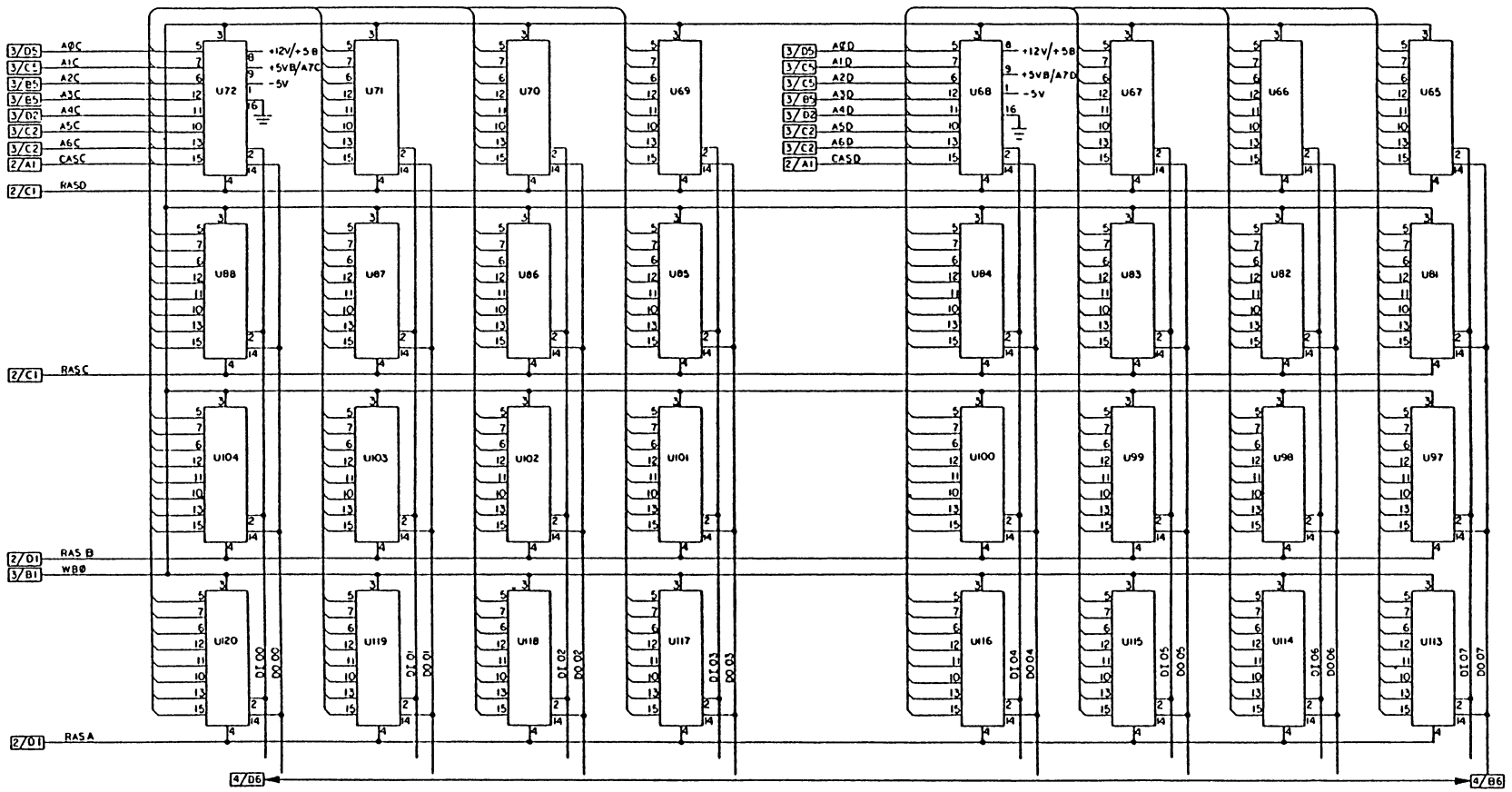

BYTE 0

RAM ARRAY

DASH NO	MODEL	DESCRIPTION	MATERIAL
		INITIAL APPLICATION	
		DWG	
		CHK	
		ENG	
		APPR	

Tandata

SCHEMATIC DIAGRAM
MM-140

SIZE	CODE IDENT	NUMBER	REV
D	29737	102417	C

SCALE NONE SHEET 5 OF 9

102417 C

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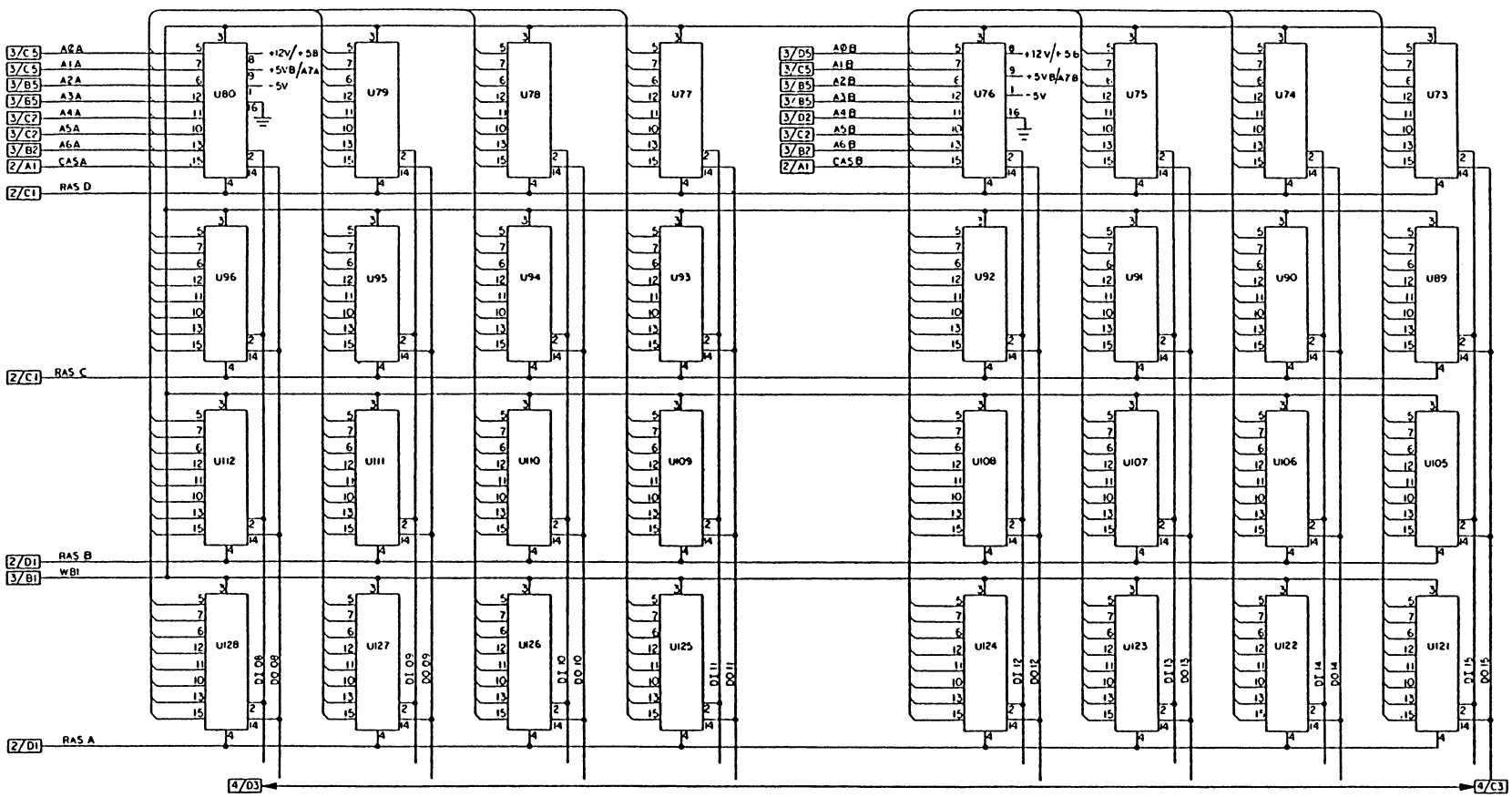

BYTE 1
RAM ARRAY

DASH NO	MODEL	DESCRIPTION	MATERIAL
INITIAL APPLICATION			
DRWN		Tandata	
CHK		SCHEMATIC DIAGRAM	
ENG		MM-140	
APPR			

SIZE	CODE IDENT	NUMBER	REV
D	29737	102417	C
SCALE NONE		SHEET 6 OF 9	

102417 C

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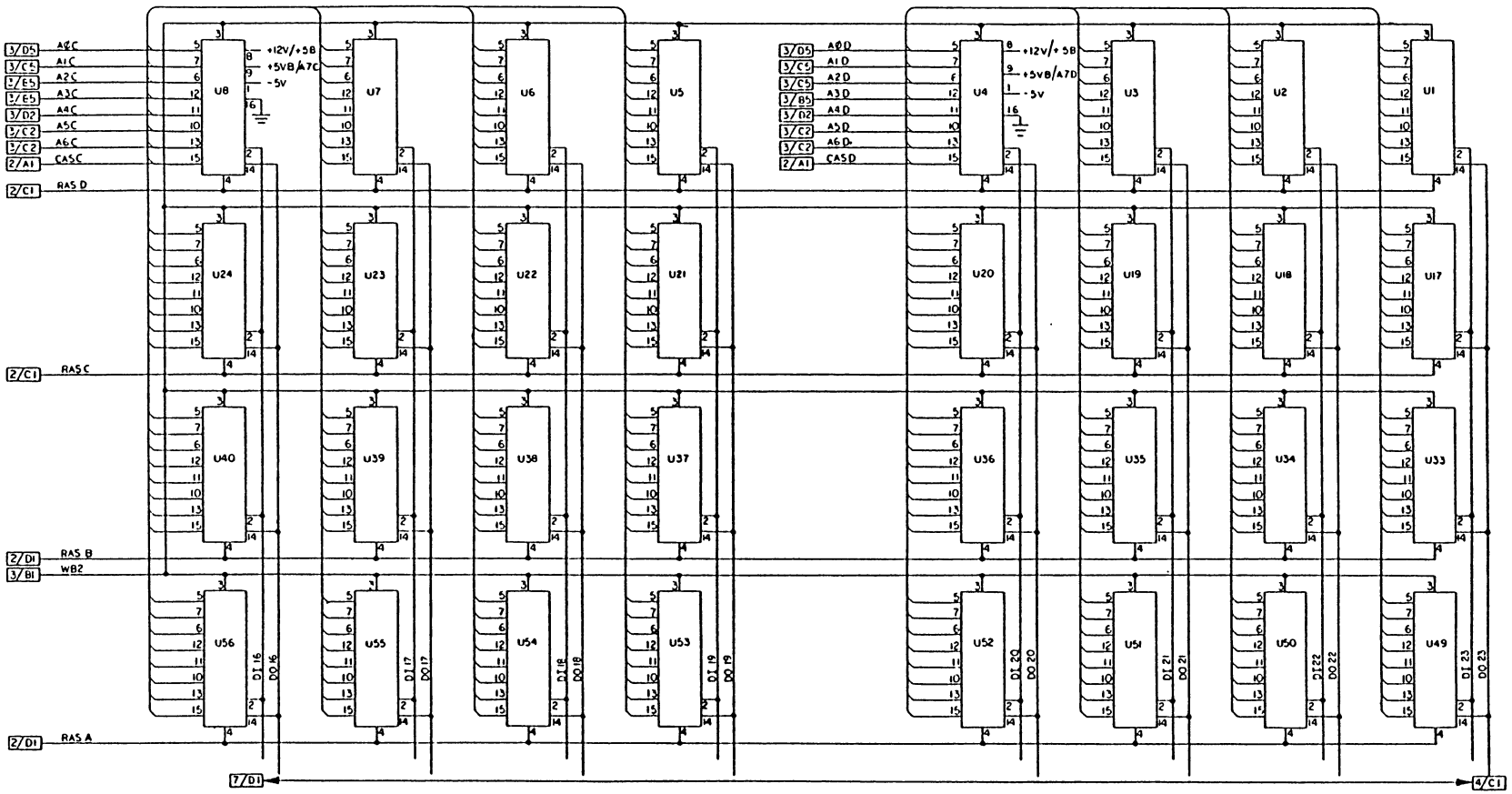

BYTE 2

RAM ARRAY

DASH NO	MODEL	DESCRIPTION	MATERIAL
		INITIAL APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES AND INCLUDE THICKNESS OF PLATING

TOLERANCES

DRWN

CHK

ENG

APPR

DIMENSIONS AND TOLERANCES PER ANSI Y14.5

MATERIAL

FINISH

Trendata

SCHEMATIC DIAGRAM
MM-140

SIZE	CODE IDENT	NUMBER	REV
D	29737	102417	C

SCALE NONE

SHEET 7 OF 9

102417 C

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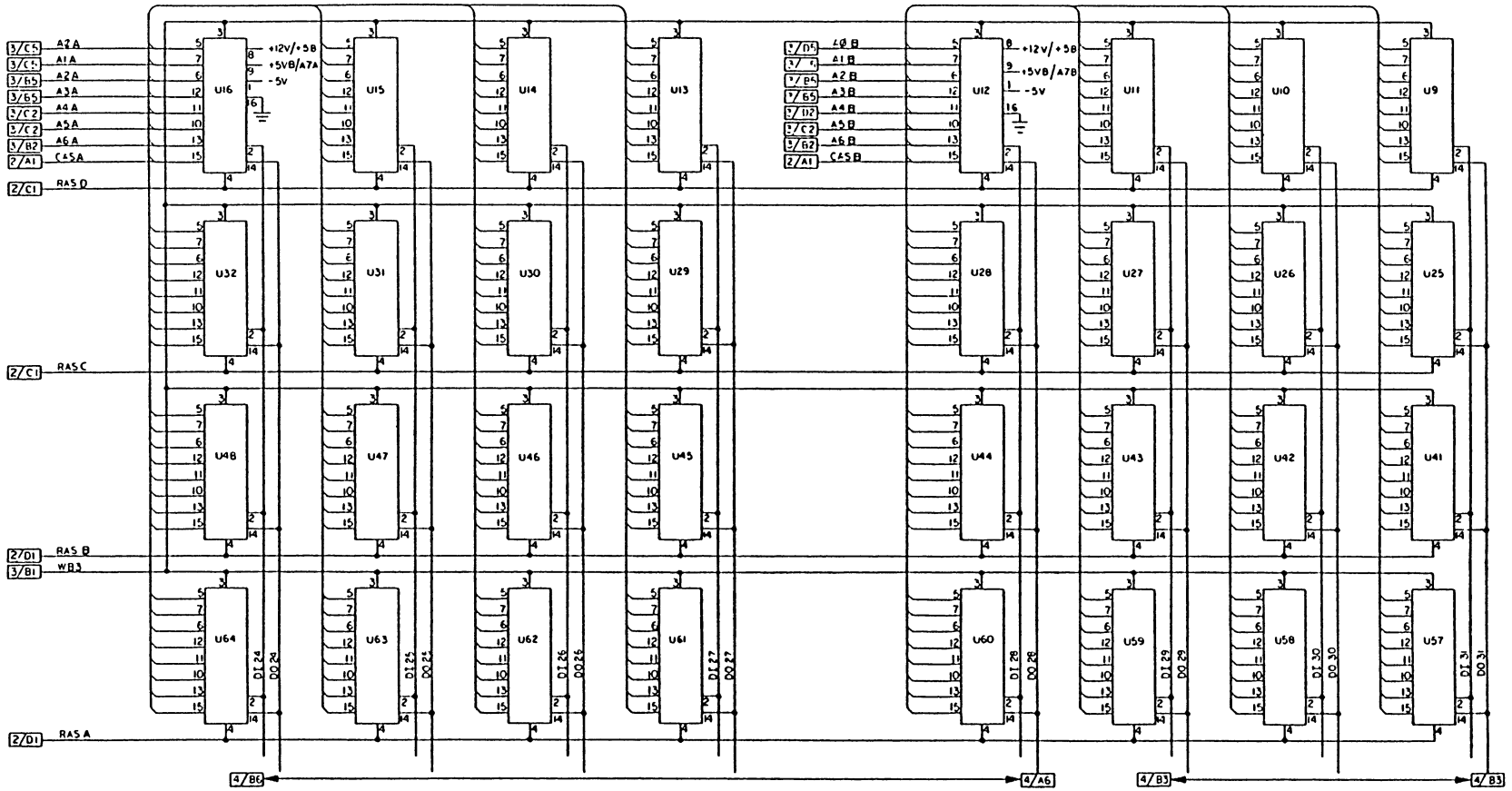

BYTE 3
RAM ARRAY

BASH NO	MODEL	DESCRIPTION	MATERIAL
INITIAL APPLICATION			

Trendata

SCHEMATIC DIAGRAM
MM-140

SIZE	CODE IDENT	NUMBER	REV
D	29737	102417	C

SCALE NONE SHEET 8 OF 9

102417 C

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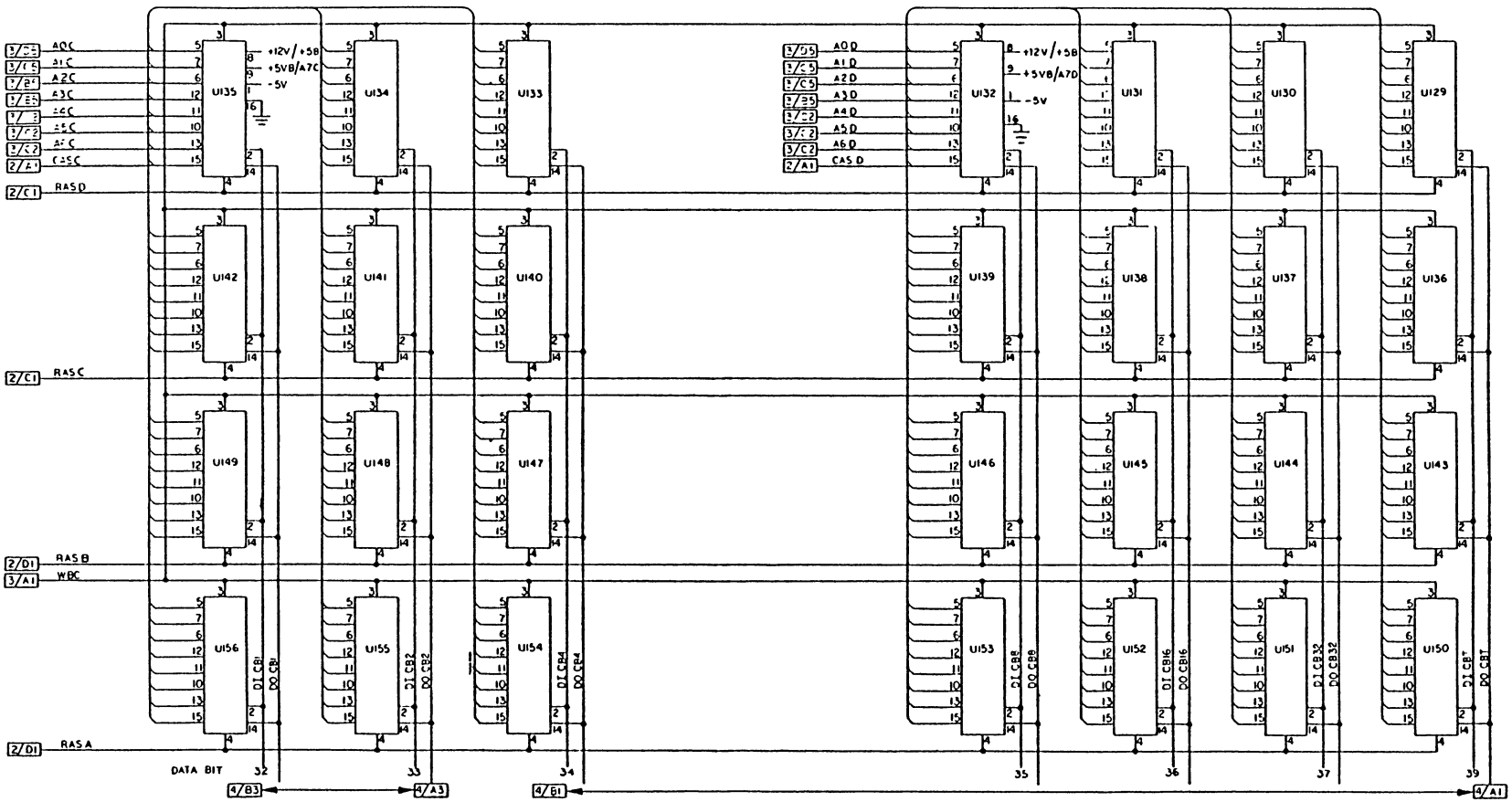

BYTE CB
RAM ARRAY
CHECK BITS

DASH NO	MODEL	DESCRIPTION	MATERIAL
INITIAL APPLICATION			
DRWN			
CHKD			
ENG			
APPR			

Tandata

SCHEMATIC DIAGRAM
MM-140

SIZE	CODE IDENT	NUMBER	REV
D	29737	102417	C

SCALE NONE SHEET 9 OF 9

102417 C

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STANDARD MEMORIES

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